THE MONTHLY

Review

APRIL ✦ ✦ ✦ 1945

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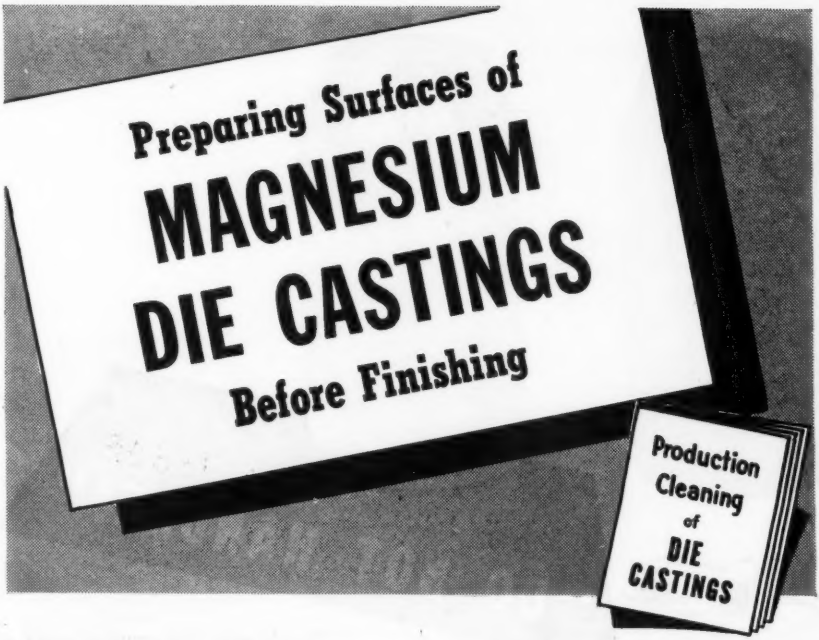

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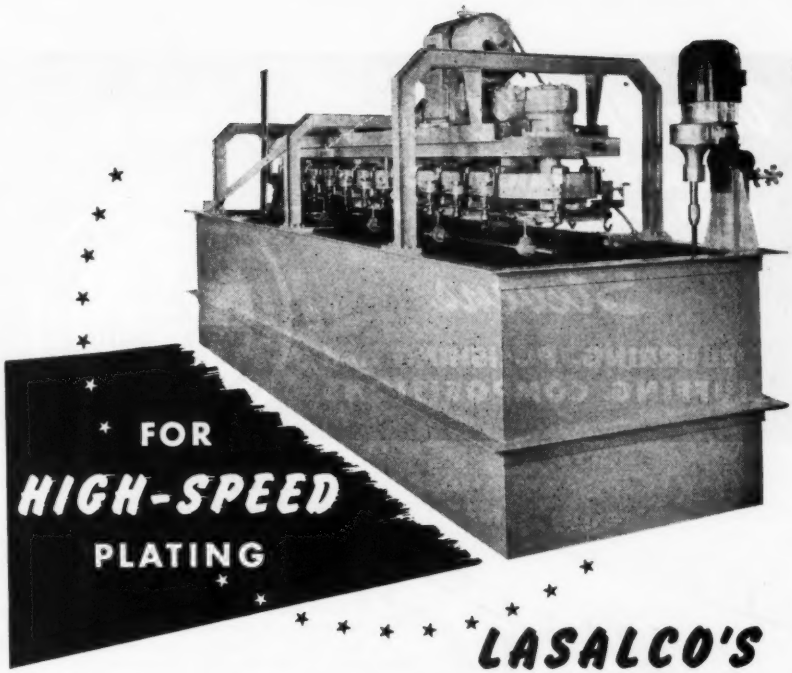

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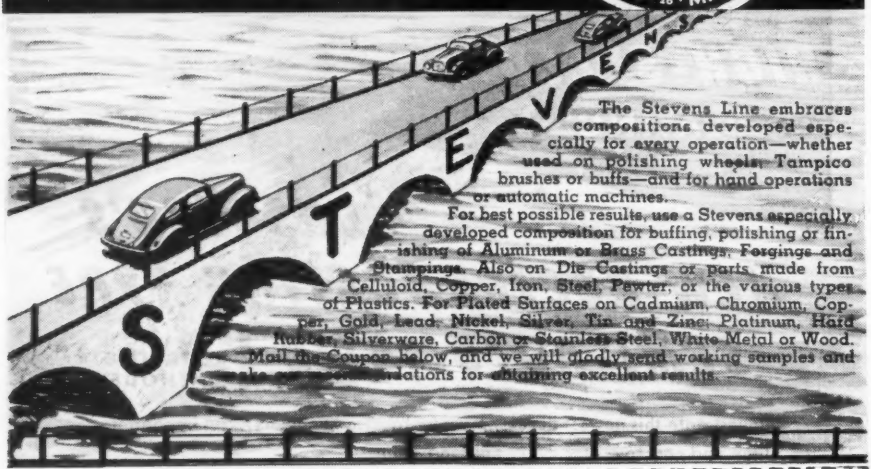

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SYNTHETICS AND ENGINEERED CORROSION CONTROL

BY D. F. SIDDALL
DIRECTOR OF RESEARCH
THE U. S. STONEWARE CO.

CHEMISTRY is defined as the science which treats of the properties of elementary and compound substances and the laws which govern their molecular and atomic relations. Such a definition may be interpreted to include a constructive force whereby substances and laws combine to produce a useful material and a destructive force whereby useful materials are consumed or destroyed. Technically, the scientist is daily faced with problems involving these forces as they exist in an equilibrium, the control of which will determine the success or failure of his endeavors. This equilibrium between constructive and destructive forces is difficult to control and from our knowledge of chemistry and the complexities of the inner-relationship of these forces, we may find that it would be much more to our advantage to study the laws and substances which may be used to control the destructive forces. For the most part, the greater share of our effort in research and development is applied to the study of constructive forces which involve further complicated studies in the control of additional destructive forces. As the chemist adds and subtracts the atoms and molecules in a reaction flask, he is primarily concerned as to how, why and what he gains as a useful product. The chemical laws that he employs will also tend to destroy, as well as create, and this problem of destruction or corrosion is one of the most important phases of chemical engineering where the laws of mass action, thermo dynamics, fluid flow, pressure, high temperatures and economics are considered, merely by multiplying the quantities involved in the creation of a product which is both economically and chemically sound. Common use is made in the laboratory of glass and its resistance to corrosion is well known. In the manufacturing plant, however, there are other properties and requirements that must be considered and these, for the most part, determine the materials that may be selected. In addition to the direct contact of processing equipment with a corrosive medium, other indirect destructive forces are brought into play, such as weathering, oxidation, spillage, fumes and condensates. It has been estimated that these forces of corrosion destroy two to two and a half billion dollars worth of useful materials every year in this country alone. It is, therefore, evident that any and all technical advancements made in the research and control of corrosion is well worth considerable effort on the part of every industry, regardless of the nature of its activities.

Before we can intelligently prevent corrosion, we must understand its causes. The knowledge of the causes of corrosion will apply directly to corrosion resisting materials and indirectly to a substance which will protect or prevent corrosion. We define corrosion in the usual sense as the act of eating away gradually, to consume, or to disintegrate, this being based upon all substances subject to external chemical attack. Technical definitions of corrosion, generally confined to metals and their alloys, describe it as a destructive alteration of a metal or alloy in contact with mediums capable of creating a chemical reaction. Both organic

*Presented to Waterbury & Philadelphia Branches.

and inorganic materials are corroded or disintegrated by acids, alkalies, salts, natural waters, brines, air, gases, electrical currents, agitation and high temperatures. In clarifying the types of corrosion, three things must be considered. First, any or all factors that influence corrosion may vary in their degree. Second, these factors may exist in an infinite number of combinations, and Third, environmental conditions may activate or passivate any one or all of the single factors or a combination of factors to a greater or lesser degree. Therefore, each distinct type of corrosion should be determined, studied and controlled as an isolated entity, irrespective of its combination with all other factors. Obviously, a protective medium combining the properties that control all corrosive factors regardless of the combinations, would be the ideal protector.

The common forms of corrosion are:

1. Direct chemical action with the formation of soluble or insoluble by-products.
2. Pitting, a less severe form of chemical action.
3. Dezincification or the reaction between the corrosive agent and certain constituents of a metal or alloy.
4. Galvanic action or the coupling of two dissimilar metals a conductive medium.
5. Solution cells or the corrosion caused by localized differences in concentration and in absorbed oxygen.
6. Corrosion fatigue or the increased reactivity of a substance when under a stressed or strained condition.

In addition to the general factors of corrosion mentioned, there are complex factors which seem to be accelerators of corrosion rather than a direct cause of corrosion, itself. The presence of dissolved air or oxygen in a solution will accelerate corrosion and will exhibit itself most prominently at the solution level, this phenomena being known as water line attack. On some metals, such as aluminum, the effect of aeration inhibits the corrosion rate. Agitation contributes to corrosion by the creation of solution cells and by causing a greater absorption of oxygen. Agitation also will set up a solution cell by forming differential aeration and will also appear to accelerate corrosion by the movement of the solution causing some abrasion or erosion, thus destroying any passivated film formed on the metal. Films formed on a surface as a result of a chemical reaction are known to accelerate or inhibit the rate of corrosion. If the films formed are stable, insoluble, adherent and non-porous, the rate of the corrosion will be retarded. Lead anodes and linings in contact with chromic acid provide such an example. If the films formed on metal are not uniform, a tendency to accelerate corrosion will be brought about by the formation of a galvanic cell. High temperatures and differences in temperatures increase the rate of corrosion. It has been indicated that the rate of corrosion will be increased three to four times for each 50 degrees rise in temperature. On the other hand, there are certain metals which, at low temperature, are corroded and at high temperature form a passivated protective film. Eddy currents of electricity cause corrosion when such currents are caused by too high an impressed voltage or when processing equipment does not provide adequate electrical protection.

From this brief discussion of the types of corrosion, it is seen why a substance is corroded and why one cannot designate any one type of corrosion as being the major contributing factor. Knowing this, we are then confronted with the problem of the development of a protective lining or film which will not only be inert to the forces of corrosion, but which will also prevent the penetration and transmission of the corrosive agent through the film.

In a broad sense, all materials, both organic and inorganic exhibit some form of resistance, or in other words, all the materials differ in their degree of stability, dependent upon environmental conditions. It remains, therefore, to qualify these materials having the greatest degree of stability or inertness under the most extreme conditions. A word of caution at this point. The most extreme conditions of corrosion are not to be accepted as a true nor absolute test under which all materials are to be evaluated. Less severe conditions may accelerate corrosion as in the case of specific metals or in protective linings, depending upon the type of corrosion. By choosing the most severe conditions of test, one determines only the limit to which that material can be extended under specific conditions for a definite length of time. Other materials under like conditions may show up better or worse, dependent upon their

chemical composition. Protective mediums may be derived from an inorganic or organic origin. Included in the inorganic class are the ferrous and non-ferrous alloys, glass and ceramics, each of which have played a familiar role in the construction and protection of chemical process equipment. The organic protective mediums have included rubber, plastics, synthetic resins and bituminous base products. Protective mediums may also be classified with respect to their constructional features. Process equipment may be constructed entirely of a material inert to a wide range of corrosives. Chemical stoneware, cast and molded plastics, and resistant alloys are examples of this class. On the other hand, process equipment may be constructed of a metal and then suitably protected by linings from rubber, plastics, coatings of synthetic resins, glass, vitreous enamels and bituminous products. It is the purpose of this discussion to investigate the causes, effects, methods of prevention and the materials to prevent corrosion, and will be confined further at this point to organic substances suitable for use as protective linings.

Our first consideration must deal with the question, Why do some organic substances resist disintegration and prevent corrosion while others do not? It is best that we answer this question negatively by considering why organic substances do not resist nor prevent corrosion, and these factors are:

1. The inability of organic substances to prevent the transmission of a corrosive agent with the organic substance in the protective medium. It may also be transmitted electrically by the attraction of substances within the organic lining, either inherent or induced.
2. The chemical composition of an organic substance is such that a chemical reaction can take place. This is generally true of low molecular weight compounds and an example would be direct bromination, nitration, sulfonation, etc.
3. The solubility of the organic substances in a corrosive solution or its solubility after a chemical reaction has taken place. It is obvious that a lining cannot protect steel if it is dissolved by the corrosive agent and in the same way, if the lining or protective medium is chemically changed to a soluble by-product, then it likewise would not prevent corrosion.

These conditions whereby a substance will serve as a protective medium now indicates a differentiation in the meaning of corrosion resistance and corrosion protection. A material may be corrosion resistant but may not prevent corrosion. A material cannot prevent corrosion and still not be resistant to the corrosion. Therefore, in the evaluation and choice of protective mediums of process equipment, the lining must first be a corrosion protector and, secondly, a corrosion resistant. The qualifications of the ideal corrosion protector would be, First, to be chemically inert and have no affinity for any corrosive agent, regardless of temperature and it must not within itself contain substances foreign to itself, which themselves exhibit any chemical affinity. It and the ingredients it contains must resist chemical reactions, such as by substitution and addition. Second, it must resist a chemical reaction, regardless of the length of contact with the corrosive, the temperature and the pressure. Third, it should be a pure inert material, containing no impurities which could be attacked or dissolved out by a corrosive agent. Fourth, it must be insoluble under all conditions, and must not be subject to partial solubility at high and low temperatures. Fifth, it should in the light of physical requirements, combine chemical and physical qualities and be a non-conductor of electricity. Sixth, it must not contain nor induce electrical forces or couples which would set up a corrosion tendency.

As a rule, the most resistant of organic substances are found among those materials which can chemically combine through their reactive forces to form high molecular weight polymers. To explain why these high molecular weight polymers resist disintegration, one must first consider how these molecules have been added together and form a polymer. Suppose, for example, that we have a number of molecular building units or monomers, each identical to its neighbor, and each containing two positions on the molecule whereby it can attach itself to its neighbor. By mixing a number of these monomers, we increase the opportunity for all the molecules to become satisfied or to become at-

tached, and by controlling the conditions under which these molecules will attach themselves, we can control the molecular weight of the polymer formed and the way in which they will attract and attach to each other. We may form a long chain which may extend in two directions, in other words, a polymer having length and width. We may, also, choose the type of monomer which will give us a polymer having length, width and depth. Regardless of the type of polymer that we choose to make, our first requirement in the development of a corrosion resistant membrane will be to completely satisfy all of the bonds of the monomers after the polymer has been formed. Should the polymer contain any possibility of further chemical reaction, a corrosive agent could distintegrate the polymer at that point. An example of such a structure would be the high molecular weight waxes and resins, such as poly ethylene and polyvinyl chloride. Such a material would be inert because of its complete saturation, the absence of affinitive bonds, and its resistance towards breakdown of the bonds which make up the polymer. An organic substance may be inert because of its molecular forces or electrical repulsion. If a lining would attract a corrosive agent, there is a possibility that that corrosive agent could add to the molecule, under certain conditions, and would destroy its physical and chemical properties and thus affect its performance as a protective medium. There have been cases where an organic substance establishes an equilibrium between itself and the corrosive agent. An example is given in the case of certain types of rubbers which will absorb the acid but after having absorbed it, tends to harden and then prevents further penetration. An equilibrium is then set up as to the amount of acid absorbed and the amount of acid transferred back into the corrosive solution.

An organic lining is broken down if the energy of the corrosive force is greater than the bond energies or the bond strengths that ties the individual molecule or polymers together. Under severe conditions of corrosion, coupled with temperature and pressure, this force is known to have caused complete breakdown. As mentioned before, progressive addition and substitution breaks the molecule down. The higher the molecular weight of the polymer, the more it will resist corrosion and the lower the molecular weight, the greater the chance for chemical breakdown and penetration. In speaking of high molecular weight polymers, we would have two general types to choose from, the thermoplastic and the thermosetting or curing type. In the thermosetting type, or the three dimensional polymer, a chemical reaction needs to be started in order to convert the organic material from one form into another. This curing or setting may be brought about by catalysts or by heat, but regardless of how it is started, it cannot be absolutely stopped. For practical reasons, it is assumed that the material is cured or has set when it reaches a point determined by physical tests. However, under many conditions, this reaction will continue at a very slow rate, until a point is reached where it will either fail chemicaly or physically. An example of such progressive curing of a polymer is taken from paint technology. It is well known that paint films are cured or set by the use of driers or catalysts within the paint film which cause an absorption of oxygen and which in turn will convert it to a hardened film. During the life of the paint film, this reaction is going on progressively until a point is reached where the film itself becomes brittle or shrinks and this causes a complete breakdown of the paint, generally termed a "weathered" film. A similar reaction can be observed in certain types of rubbers and in certain types of thermosetting plastics. In a like manner, there are certain conditions which will depolymerize a curing or setting type of polymer acting in a reverse manner than that mentioned before. A thermosetting resin or curing polymer may break down due to the fact that the reaction has not been carried far enough and still contains some unsatisfied bonds in the polymers and the corrosive agents can attach itself by addition or substitution. An example of this type would be the use of under-cured rubber, or low baked phenolic resins. If the corrosive agent contains a solvent for a polymer, the corrosive attack is increased merely because a solution is formed, the polymer is isolated, and the corrosive agent can break the polymer down easier.

If the polymer is of a thermoplastic type or a two-dimensional polymer, it is broken

down by extremely severe conditions which rupture the chemical bonds. In order to make a thermoplastic polymer useful as a lining, especially with respect to its physical characteristics, compounding ingredients must be added. The choice of these compounding ingredients, such as fillers, stabilizers, lubricants, pigments and plasticizers require a compromise between chemical resistance and physical properties. It is most apparent with this type that the compounding ingredients must be as inert to the corrosive agent as is the thermoplastic polymer itself. Excessively high temperatures soften the thermoplastic types and as a rule, breakdown is noted mainly from a physical standpoint, rather than by chemical disintegration. It has sometimes been noticed in the case of thermoplastic resins that embrittlement occurs, in which case the lining will fail physically. This phenomena cannot be explained, except that it has been proven that further links between the polymers are formed which would be in reality, a cure. The thermoplastic resins exhibit solubility, especially in certain types of organic solvents and this characteristic is a definite disadvantage.

In choosing the proper type of process equipment, the choice must be made, first, as to service, second, as to cost, and third, as to ease of repair. As outlined before, chemical process equipment may be divided into two types, the first being those materials which are inert and resistant throughout the entire construction, and those which have been protected from corrosion. The first class includes wood, either plain or impregnated, ferrous and non-ferrous alloys, chemical stoneware, carbon and graphite products, molded hard rubber or ebonite, and molded thermosetting plastics. The major types of protective liners may be further sub-divided into rigid and flexible types. Included in the rigid type of protective mediums are acid proof brick or tile and acid proof cements, glass linings, porcelain enamel and hard baked phenolics. Included in the flexible type of protective liners, are natural and synthetic rubber linings and those prepared from thermoplastic resins. The performance of each of these materials is yearly reported by Chemical and Metallurgical Engineering in their Materials of Construction Report.

There remains now to discuss factors in choosing the proper protective medium. The performance of the material with respect to its resistance to the chemical, physical and electrical conditions is of most importance. There is no single material which will resist all acids and alkalies under all conditions. The only safe method in evaluating a protective medium is to conduct these tests under the actual field conditions. Laboratory tests give only a relative evaluation of the material. Accelerated laboratory tests do not and cannot duplicate the actual conditions under which the material must resist a corrosive agent. Breakdowns will occur at elevated temperatures which normally would not occur at the temperature at which the process is to be carried out. The cost of the fabricated metal and the application of the protective medium is second in importance. If process equipment is to be constructed from special designs to accommodate a certain type of lining, the cost is excessive. The cost of protecting process equipment should be evaluated primarily on the basis of the service that it gives and in its initial cost. It is quite evident that a lining costing $2,000.00, giving ten years' service, is much more economical than a lining cost $200.00, giving eight months' service. The method of applying the lining affects the cost, not only from the manufacturer's standpoint, but from the customer's standpoint. If process equipment can be protected at the point where it is to be used, the ultimate cost is much lower. Many times, the savings made in freight alone proves more economical than the use of linings which require special equipment at its source of manufacture. In using process equipment, mechanical damage is unavoidable. The ease of repair of a lining is a very important factor to consider, especially on equipment, which is subject to considerable stresses, strains and impacts. The time required to make necessary repairs will also influence the cost of a protective medium. If a unit is to be taken out of production and shipped to a manufacturer for repair, the over-all cost of the protective medium will run quite high. The adaptability of a protective lining to resist a wide range of corrosive agents is another factor to be considered in selecting a protective coating. Many times, a process will be changed and the corrosive agent may be changed from acidic to alkaline. If the protective me-

dium is narrow in its range of resistances, it is therefore necessary that the entire equipment be reprotected, which again adds to its cost. If a protective medium in contact with the corrosive solution contaminates the solution, such as in plating tanks, the scope of such a protective lining would be very narrow. It has been recognized by electro platers that in some cases organic materials influence the plating solution by leaching out substances which are actually inhibitors.

In submitting a problem to a process equipment manufacturer, a complete picture must be presented and all factors concerned in its operation should be given to that manufacturer. The type of unit, the corrosive solution and its concentration, the maximum and minimum operating temperatures, the by-products formed in the solution, the presence or absence of abrasive materials, and the agitation of the solution and the method of heating the solution, whether it be internal or external, must be completely outlined. It is this information, plus full cooperation as far as testing is concerned, that spells success in applying all types of protective liners to process equipment.

The future development in protective mediums is proving to be very interesting, not only from the standpoint of improvements of old materials, but also, the development of new and unique resins, which in some cases have exhibited phenomenal resistance to corrosive agents, heretofore known as "bad actors." The use of synthetic rubber has not been thoroughly explored and in many cases has not been satisfactorily applied as a protective coating. Realizing that the compounding and application of synthetic rubber is still in its infancy, there lies ahead the possibilities of developing better flexible linings from synthetic rubber than we had ever realized from natural rubber. The use of different types of thermoplastic resins will widen the range of chemical solutions that can be handled. The development of these resins lies mainly in the method of processing and of com pounding. The resins themselves show extreme resistance to many acids and alkalies. However, they must be compounded to meet physical and electrical requirements, other than the chemical qualities which it inherently possesses, and the compounding ingredients that are used, determine the length of service that it will give.

AMENDMENT PROPOSED BY BALTIMORE-WASHINGTON

The Baltimore-Washington Branch submits the following change in the By-Laws, Supreme Society:

(New text is placed within parenthesis)

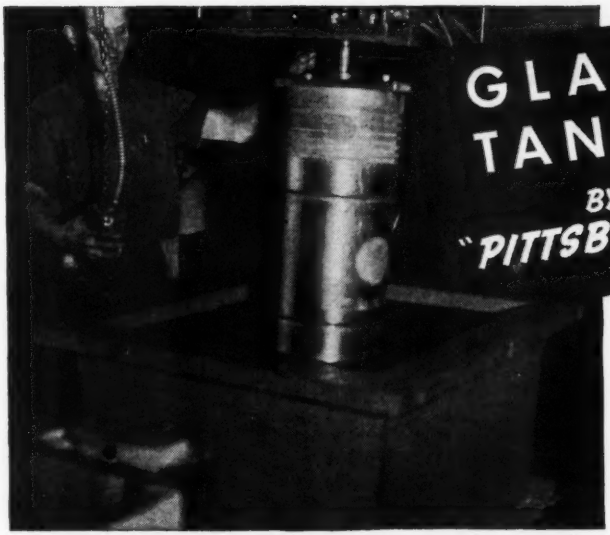
Part 1. Supreme Society

ARTICLE VI

Section 6, now reads as follows: Research Committee: (a) The President shall appoint the Chairman of the Research Committee, who shall select from eight (8) to twenty (20) persons who are either active or associate members of the Branch Societies. This committee is authorized to solicit funds for research from persons, firms or organizations. (b) Such funds shall be held in custody by the Executive Secretary of the Society and disbursed with the approval of the Chairman and the Sub-Committee on Disbursements (etc).

Change Section 6 to read as follows: :

Research Committee: (a) (The Research Committee shall consist of nine persons who are active or associate members of Branch Societies, the Executive Secretary and one representative from each Technical Organization that may be designated by the Executive Board. The nine members from the Society shall be appointed by the Executive Board. Of the original appointees from the Society, three will serve for a three-year period, three for two years and three for one year. Three new members will thereafter be appointed each year for a term of three years, but no member shall be appointed to the Committee shall elect one of its members appointed from the Society as Chairman, who shall serve for a term of one year. No person shall serve as Chairman of the Committee for more than two consecutive terms). This committee is authorized to solicit funds for research from persons, firms or organizations. (b) Such funds shall be held in custody by the Executive Secretary of the Society and disbursed with the approval of the Chairman (and the Executive Secretary), etc.



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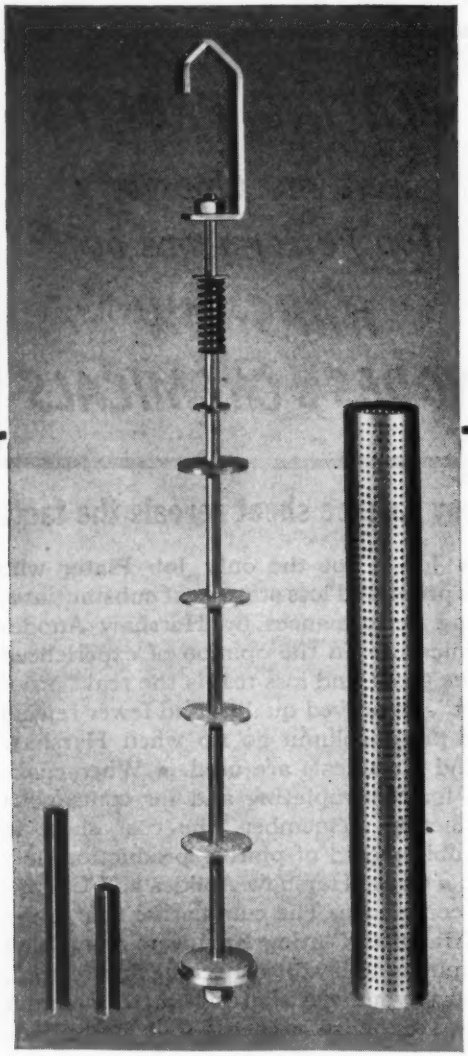

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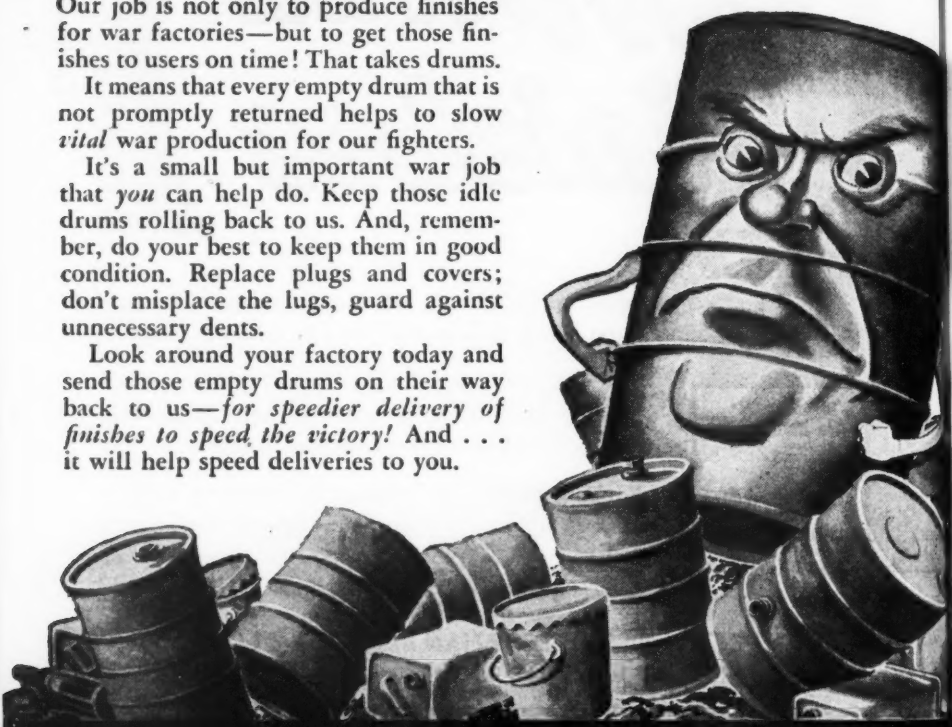

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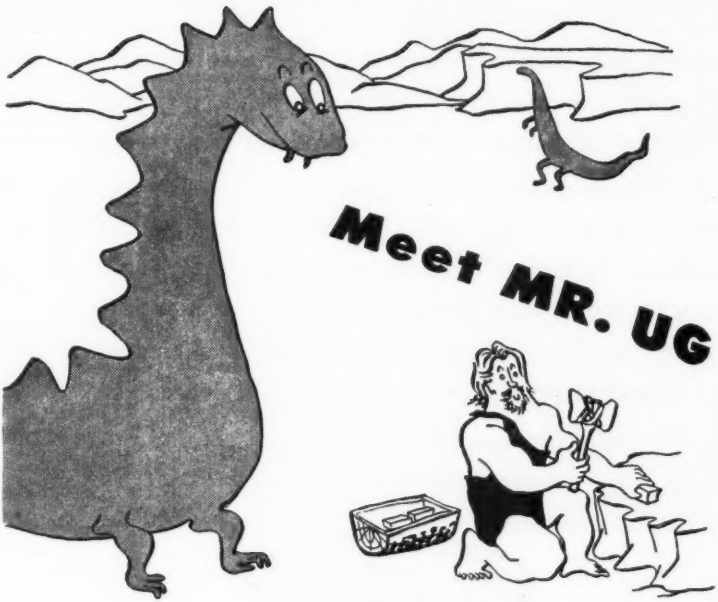

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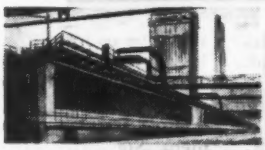

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Science and ELECTROPLATING

BY E. W. COX

THERE are two main types of conductors, primary and secondary. Generally the metal and alloys are primary conductors, the electric current passing through them without any chemical change taking place, although heating, which is a physical change does occur. Secondary conductors are fluids, in which chemical decomposition takes place with the passage of electric current. Such action is known as electrolysis. All electroplating processes come under this heading.

Faradays Laws of Electrolysis govern the behavior of fluids when current is passed through them.

(1) The quantity of substance deposited at the cathode or corroded at the anode is proportional to the quantity of current passed.

(2) The quantities of different substances deposited at the cathode and corroded at the anode are proportional to their equivalent weights.

According to the theory of electrolysis the passage of current through an electrolyte is due to ionic dissociation i.e. the chemical compound in solution breaks up into constituent ions, which are atoms or groups of atoms positively or negatively charged electrically. For example, in the acid copper plating bath, the essential constituent is copper sulphate ($CuSO_4$) which ionizes

$$CuSO_4 \rightarrow Cu^{++} + SO_4$$

We therefore have three substances in the solution, undissociated copper sulphate, which takes no part in the electrolysis, positively charged copper ions (Cu^{++}) and negatively charged sulphate ions (SO_4^{--}). The current passes through the solution by virtue of the movement of the ions to an electrode of the opposite charge, i.e. the copper ions are attracted to the negatively charged cathode, and the sulphate ions to the postively charged anode.

The positive charge on the copper ion is neutralized by the cathode and neutral metallic copper is deposited, and if conditions are right we get a continuous adherent deposit known as a plate. The negative charge on the sulphate ion is neutralized by the anode, and it either combines with the copper anode to form more copper sulphate, or combines with water to form sulphuric acid (H_2SO_4) and oxygen (O_2).

Sulphuric acid is also present in the acid copper bath and ionizes as follows:

$$H_2SO_4\ 2H^{++} + SO_4^{--}$$

therefore positively charged hydrogen ions (H^+) will also be present in solution, and according to the potential drop across the bath and concentration of sulphuric acid, hydrogen will be plated out with the copper. If the presence of acid in the solution, causes the deposition of hydrogen decreasing the acid content, e.e. increasing the pH value will be desirable if the presence of excessive hydrogen unfavorably affects the plated metal. This effect is most important in the case of nickel plating from the sulphate bath.

ASTC (Chem. E., Met.), A.A.C.I. Metallurgist: Duly & Hansford Ptd. Ltd. Delivered before the Sydney (Aust.) Branch of the American Electroplaters' Society at the Second General meeting held on 8th February 1944, at the Chamber of Manufactures, 12 O'Connell Street, Sydney.

Before proceeding with further explanation it will be necessary to briefly discuss the electromotive series of metals.

If a metal electrode is dipped into a solution of one of its own salts a "single potential" exists between the electrode and the solution under definite standard conditions i.e. a normal solution of the metal salt at 25° C. and with an extremely small current density. It is necessary to have standard conditions so that a series of metals can be compared. From this it is possible to arrange a series of metals in descending order of their "single potentials" as follows:

Aluminum,
Zinc,
Chromium,
Iron,
Nickel,
Tin,
Lead,
Hydrogen,
Copper,
Silver,
Gold.

The above elements form part of what is known as the electromotive series and are in their correct order and comprise most of the metals which interest us as electroplaters. Those metals higher up in the scale have a greater tendency to dissolve than those lower in the scale. This will be evidenced by the fact that Aluminum and Zinc are never found in nature in the native state, whereas metals lower in the scale, i.e. more electro-negative such as silver and gold and sometimes copper, occur naturally in the metallic state.

It will be noticed that copper is below hydrogen and therefore under standard conditions, will plate out more readily than hydrogen, therefore the concentration of hydrogen ions can be much higher in the acid copper bath than say in the nickel sulphate bath as nickel is more electropositive than hydrogen and will therefore plate out more readily and as hydrogen has an embrittling and darkening effect on the plated nickel, the acid content, i.e. the pH value has to be carefully controlled.

In the case of a primary conductor the voltage between any two points can be obtained by multiplying the resistance by the current flowing according to Ohm's Law. Owing to decomposition occurring when current is passed through a secondary conductor or electrolyte new factors are introduced. We have

(a) IR voltage drop or resistance of solution,
(b) Opposing EMF of the electrolyte acting as a cell.
(c) Anode and cathode polarisation.
(d) Anode and cathode over-voltage.

Taking the above factors in turn:

(a) It will be remembered that the passage of current through an electrolyte is due to the presence of ions which move mechanically towards the electrode. Therefore the resistance of the solution will vary with:

(1) Number of ions present, i.e. concentrated solutions will have lower resistance than weaker solutions. Substances which ionize readily like sulphuric acid will have a long resistance.
(2) Variation in ionic mobility of the ion.
(3) Variation in temperature of the solution. Higher temperatures result in lower viscosities giving better ionic mobility and therefore lower resistance.

(b) All electrolytic cells including plating baths have what is known as an opposing EMF, i.e. they act as a cell or "battery" opposing the EMF produced by a generator. This results in an additional voltage required to pass a given amount of current through the cell or plating bath. The existence of this potential was evidenced in the discussion on the electromotive series.

(c) Polarisation is an insulating effect associated with ionic behavior in the anode and cathode solutions. At the cathode an impoverishment of ions takes place if they are plated out from solution quicker than they can be replaced by the ionic dissociation of the substance in solution. In the same way at the anode we get a building up of an excess concentration of ions which have been corroded from the anode and if corrision takes place quicker than the diffusion of the ions through the solutions this excess of ions occurs which tends to stop any more being corroded. It will be readily seen that polarisation increases with current density in the normal case. The degree of polarisation in a plating bath is important because it has an effect on throwing

power. Cyanide baths generally have a higher polarisation than baths like the acid copper bath largely due to the presence of complex ions in the former resulting in two ionic equations to produce the metallic ions. In the case of the cadmium bath we have:

$$Na_2Cd(CN)_4 \rightarrow 2Na^+ + Cd(CN)_4^{--}$$
$$Cd(CN)_4 \rightarrow Cd^{++} + 4CN^-$$

Compared with the acid copper bath where we saw that only one equation was required to produce the copper ion, in the cyanide copper bath, the same ion is made available much less readily and therefore impoverishment of the copper ion around the cathode takes place more readily, building up the insulating effect which is polarisation. A side recation takes place as result of the low copper ion content resulting in the liberation of hydrogen, particularly if the "free cyanide" content is high. In the acid copper bath unless the sulphuric acid is extremely high, a comparatively small volume of hydrogen is produced at the cathode due to the lower polarisation.

(d) Over-voltage like polarisation is essentially an insulating effect built up at the anode and cathode but refers to the effect produced on the surface of the electrode. It deals with the insulating effect produced by the liberation of hydrogen gas at the cathode and oxygen and other gases at the anode. It varies with different metals, with current density, with concentration of the solution and with the condition of the electrode surface. There are many theories in existence to explain over-voltage. It is generally thought that it is associated with the formation of monatomic gas at the surface of the electrode.

Throwing Power

If plating solutions acted like primary conductors, i.e. the voltage drop across the bath was solely due to IR drop, then if an irregular cathode was being plated those parts which were twice as distant from the anode as the more adjacent parts would receive only half the current according to Ohm's Law. If this were the case the primary distribution would be 100%. Throwing power can be defined as the opposite of primary distribution. In other words a plating bath which tended to give a plate on an irregular cathode of even thickness both on the remote and adjacent parts in relation to the anode is said to have good throwing power. For commercial purposes it is generally not necessary to have "100% throwing power" i.e. a plate of absolutely even thickness completely covering an irregular cathode, it being understood that an irregular cathode means one having different parts at different distances from the anode. For commercial purposes a certain variation in thickness can be allowed provided that a continuous plate results all over the cathode sufficient to resist corrosion and give the necessary wear and permanence according to specification. Throwing power depends upon three main factors:

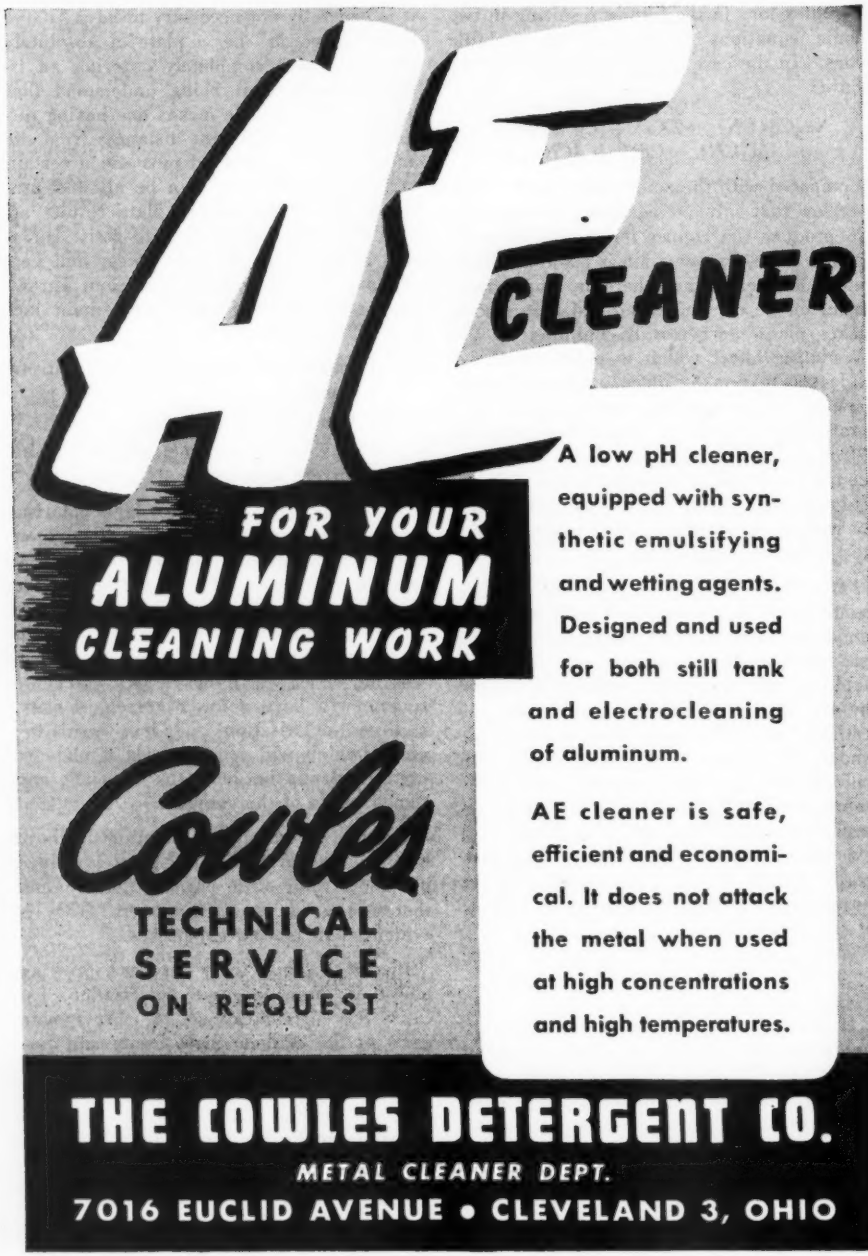
(1) Change in polarisation with current density.
(2) Conductivity.
(3) Change in cathode efficiently with current density.

A plating bath which has high polarisation will tend to have food throwing power because polarisation increases as current density increases. Those portions of a cathode which are adjacent to the anode will have a higher current density, a greater polarisation and therefore a greater insulating effect while those parts which are remote will have a lower current density, a lower polarisation and less insulating effect, which will tend to give a plate of even thickness on both the adjacent and remote parts of the cathode.

Cyanide solutions as mentioned above have high polarisation and greater change of polarisation with current density and therefore good throwing power. This is evidenced in plating experience.

Increased conductivity improves throwing power if there is some polarisation, because the current can get to more remote parts of the cathode more easily and further as the total voltage drop across the bath includes conductivity and polarisation it is evident that if the resistance is small as evidenced by IR drop than polarisation will have a correspondingly greater effect.

Where cathode efficiency decreases with increase of current density, improved throwing power will result. In the case of the nickel bath the cathode efficiency increases with current density and poor throwing power results.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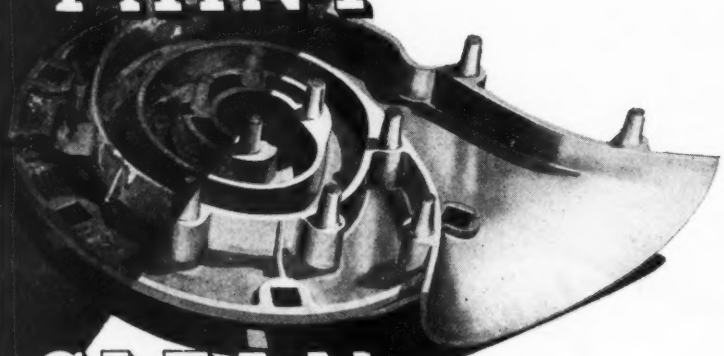

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NOMOGRAPH FOR DETERMINING AMPERAGE AND TIME OF PLATING

BY JOHN S. HART
CHRYSLER ENGINEERING LABORATORIES

THE necessary calculations for determining the time and current required to plate an article becomes tedious when they are carried out often, and errors are frequently made. In order to eliminate calculations and errors, the accompanying nomograph* has been worked out. By using it plating computations can be solved in a matter of seconds, and it is so simple that no knowledge of mathematics is required for its use. Even beginners in plating are able to use it with accuracy and confidence.

Calculations of the current for and time of plating are based on four factors which must be known. These are:

1. Area.
2. Current density.
3. Metal Plated and Bath Efficiency.
4. Thickness of deposit required.

Each of these factors is represented by a calibrated line. When the proper values are located on them and connected by straight diagonal lines, the values for current and time may be read at the intersection of the diagonals with the current and time lines.

The nomograph consists fundamentally of three simple charts so arranged, side by side, that the external lines of the middle section are also used by the end sections. The first is made up of the three lines "Area," "Current," and "Current Density." The value of the previously calculated area is located on the area line and the value of the current density is marked on the corresponding line. These two points are connected by a straight line which intersects the intermediate line at a point corresponding to the correct current.

The second section is made up of the lines "Current Density," "Metals," and "Reference." The current density line already has a point marked on it from the previous section. The next step is to mark the metal to be plated on the middle line. A straight line should be drawn between these two points and extended to the reference line. The numerals following the metals refer to the efficiency at which they were plotted. When a plating bath operates at other efficiencies a correction factor can be applied to the time of plating.

The third section begins with the reference line and also contains the time of plating and thickness lines. The desired thickness of deposit is marked on the last line. This is connected by a straight line to the point of intersection on the reference line which was located in the previous section. This diagonal will intercept the time line at a point representing the correct time of plating.

On the chart will be noted a dotted line representing the following problem. It is desired to plate 0.001" of nickel at 50 amperes per square foot on an article whose area is one square foot. This problem is solved for current and time of plat-

(*Continued on page* 365)

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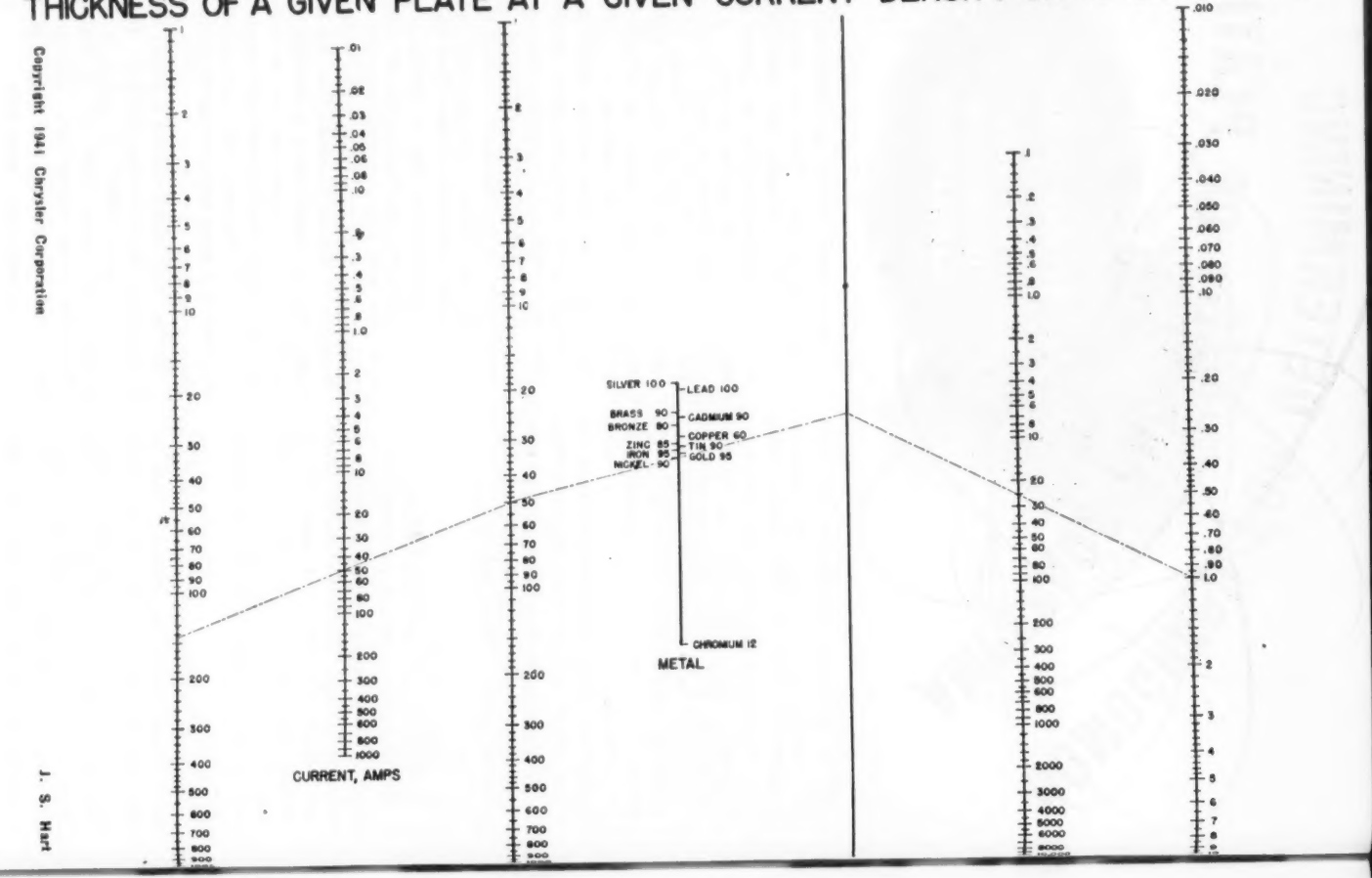
J. S. Hart

NOMOGRAPH SHOWING TIME AND CURRENT REQUIRED TO DEPOSIT A GIVEN THICKNESS OF A GIVEN PLATE AT A GIVEN CURRENT DENSITY ON A GIVEN AREA



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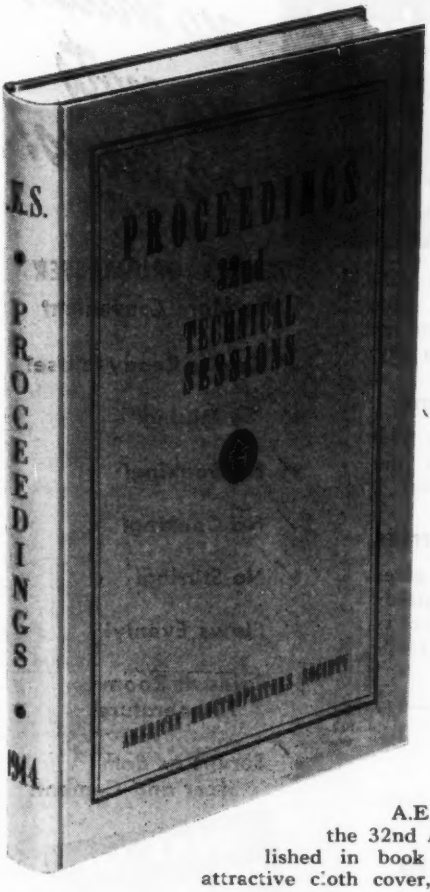

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THE FUNDAMENTALS OF CHEMISTRY FOR ELECTROPLATERS

PART XVIII

THE HYDROLYSIS OF SALTS

Samuel Glasstone, D. Sc. Ph. D.

Strong and Weak Acids

IN the preceding article (Part XVII, *Monthly Review*, March 1945) it was stated that most salts dissociate into ions in solution and hence form electrolytes which are good conductors of electricity. The great majority of salts in solution thus constitute what are known as "strong electrolytes." Some acids, such as hydrochloric, sulfuric and nitric acids, and certain bases, such as sodium and potassium hydroxides, behave like salts in yielding solutions which are strong electrolytes. However, certain acids, e.g., acetic and boric acids, and certain bases, particularly ammonia, when dissolved in water form solutions which are not good conductors. They do conduct the electric current to some extent, but the resistance is much higher than for a salt solution of equivalent concentration. The acids and bases mentioned are thus regarded as "weak electrolytes." The test of whether the solution is a strong or a weak electrolyte is used to distinguish between "strong acids" and "weak acids," and between "strong bases" and "weak bases." Thus, hydrochloric, sulfuric and nitric acids are called strong acids, whereas acetic and boric acids are weak acids. Similarly, potassium and sodium hydroxides are strong bases, but ammonia is a weak base. The essential difference between a strong acid or base and a weak acid or base is that the former, like salts, are dissociated to a large extent into ions when dissolved in water, while the latter are dissociated to a small degree only. This explains why solutions of strong acids and bases are good conductors of electricity, i.e., strong electrolytes, but the solutions of weak acids and bases are poor conductors, i.e., weak electrolytes.

Although it has been assumed above that acids (or bases) can be divided into the categories of strong and weak, this is not strictly true, for there are a number of acids (and bases) that are intermediate in character. However, the number of such substances is not large, and hence the rough separation of acids and bases into strong and weak groups may be adopted here. There are also various degrees of strength and, particularly, of weakness, but the matter is not of immediate concern.

Salts as Strong Electrolytes

In spite of the fact that acids and bases may be strong or weak, the salts of all acids and bases are almost invariably strong electrolytes which are almost completely dissociated into ions in solution. Thus, sodium borate (borax) is a strong electrolyte although boric acid is a weak acid; similarly, ammonium chloride is a strong electrolyte although ammonia is a weak base. Even the salt of a weak acid and a weak base, such as ammonium borate or ammonium acetate, would be a strong electrolyte, as a general rule, being almost completely dissociated into ions in solution. Nevertheless, because of the slight degree of ionization of the weak acids and bases themselves, the salts of such acids and bases have certain important properties which will now be considered briefly.

The Hydrolysis of Salts: Weak Acid-Strong Base

Pure water is not a good conductor of electricity, but even the purest water possesses a definite, although small, conduc-

tance. This means that water dissociates to some extent into ions; these are believed to be hydrogen (H^+) and hydroxyl (OH^-) ions, so that it is possible to represent the process by the chemical equation

$$H_2O = H^+ + OH^-.$$

It is important to remember that this dissociation takes place to a very minute extent only, but the fact that hydrogen and hydroxyl ions are present at all in pure water has important consequences. (For a more detailed treatment of the ionization of water, see "The Fundamentals of Electrochemistry and Electrodeposition," Chapter VII.) As seen above, a substance such as sodium cyanide (NaCN), which is the salt of a strong base, sodium hydroxide (NaOH), and a weak acid, hydrocyanic acid (HCN), is a good electrolyte, and so it is dissociated to a large extent into Na^+ and CN^- ions in solution. Because hydrocyanic acid is a weak acid, actually it is very weak, it can ionize to an extremely small extent only; this means that very few hydrogen ions and cyanide ions can coexist in solution. Consequently, when sodium cyanide is dissolved in water, the cyanide ions (CN^-) combine with the hydrogen ions (H^+) of the water to form molecules of "undissociated" or "nonionized" hydrocyanic acid (HCN). At the same time, free sodium ions, from the sodium cyanide, and hydroxyl ions, from the water, which together constitute ionized sodium hydroxide, remain in the solution. The interaction between the salt and water, which is a chemical process known as "hydrolysis," may thus be represented by the equation

$$(Na^+ + CN^-) + H_2O = (Na^+ + OH^-) + HCN.$$

In other words, the action of the water on the sodium cyanide is to cause it to decompose, to some extent but by no means completely, into its constituent strong base (sodium hydroxide) and weak acid (hydrocyanic acid). The fact that the base is strong, and hence largely ionized, is indicated by writing the formula as ($Na^+ + OH^-$), whereas the weakness of the acid is implied by its representation in the nonionized form, HCN. The presence of the ionized base together with the nonionized acid means that the solution contains some excess of free hydroxyl ions, and this causes an alkaline reaction to indicators. The conclusion to be drawn, therefore, is that as a result of the action of water, i.e., hydrolysis, a solution of sodium cyanide will be alkaline. This explains why cyanide plating baths are always alkaline in nature.

The arguments presented above can be applied to any salt of a strong base and a weak acid, e.g., sodium carbonate, potassium cyanide, sodium borate, etc. In every case hydrolysis results in a partial decomposition of the salt into its component strong base and weak acid. In general, therefore, the hydrolysis of a salt of a weak acid and strong base leads to a solution with an alkaline reaction to indicators.

Salt of Weak Base and Strong Acid

Just as in a solution of a weak acid there can be no appreciable amount of free hydrogen ions together with the negative ions (anions) of the acid, so in a solution of a weak base there can be few hydroxyl ions together with the positive ions (cations) of the base. When a salt of a weak base, e.g., ammonia, and a strong acid, e.g., hydrochloric acid, such as, ammonium chloride (NH_4Cl), is dissolved in water, the cations NH_4^+ combine with the hydroxyl ions (OH^-) to form the nonionized molecules of the weak base, represented by NH_4OH, leaving in solution the ions H^+ and Cl^- of the strong acid. The hydrolysis reaction may now be written as

$$(NH_4^+ + Cl^-) + H_2O = NH_4OH + (H^+ + Cl^-).$$

Here again, hydrolysis results in a partial splitting up of the salt into the acid and base of which it is constituted. In the present case, however, since the solution contains some free strong (hydrochloric) acid, it will react acid to indicators. Hence, in general, as a result of hydrolysis the salt of a weak base and a strong acid gives a solution that has an acid reaction.

Salt of Weak Acid and Weak Base

A salt of a weak acid and a weak base, e.g., ammonium cyanide, will be hydrolyzed to a considerable extent in solution, thus:

$$(NH_4^+ + CN^-) + H_2O = NH_4OH + HCN.$$

Since both acid and base are weak, however, the solution will not be very markedly acid or alkaline. In other words, in spite of appreciable hydrolysis, the salt of a weak acid and a weak base will have an approximately neutral reaction in solution.

Actually, in the present instance, it will be slightly alkaline, because ammonia, although a weak base, is a somewhat stronger base than hydrocyanic acid is an acid.

Salt of Strong Acid and Strong Base

There remains to be considered, finally, the behavior of a salt of a strong base, e.g., sodium hydroxide, and a strong acid, e.g., hydrochloric acid, such as sodium chloride (NaCl). This forms sodium (Na^+) and chloride (Cl^-) ions in solution, but since both acid and base are strong, there is no tendency for these ions to unite with the hydrogen and hydroxyl ions of water to form nonionized molecules of acid and base. Since such molecules do not exist to any appreciable extent, even in the solution of pure acid or base, there is no reason why they should be formed in the salt solution. It follows, therefore, that there is no hydrolysis when a salt of strong acid and strong base is dissolved in water. Dissociation into ions occurs, of course, but these ions remain unaffected by the ions of the water. An aqueous solution of salt of this kind has consequently a completely neutral reaction.

Hydrolysis and Neutralization

The results described above relating to the hydrolysis, and acidity or alkalinity, of solutions of salts of various kinds has a bearing on the problems of neutralization. It is evident that if a solution of a strong base is added to one of a strong acid, the mixture will become exactly neutral when the acid has been completely converted into the salt. That is to say, the solution will be neutral when an equivalent amount of strong base is added to the strong acid; this condition, known as the "equivalence point," is of importance in the quantitative (volumetric) analysis of acids and bases, as will be seen in the next article. If a weak acid is being neutralized by a strong base, however, the salt formed will be hydrolyzed to yield an alkaline solution, and so the system will have an alkaline reaction at the theoretical equivalence point. Finally, when a strong acid is neutralized by a weak base the solution will still behave somewhat acid at the equivalence point. Although a mixture of equivalent amounts of a weak acid and base will be almost neutral, the result is of little importance in analytical work. Certain difficulties arise which make it almost impossible to utilize this fact, as will be seen later.

NOMOGRAPH

(*Continued from page* 359)

ing by making a mark on the first line at 144 sq. in. and on the third line at 50 amperes per square foot. These two points are connected by a straight line which intersects the current line at 50 amps., the current to be used for plating this part. Proceeding from the 50 amps. per square foot point, a line is drawn through the nickel 95 point on the metal line and extended to the reference line. From this last intersection another line is drawn to 1.0 thousandths on the thickness column. This last diagonal crosses the time of plating line at 26 minutes.

By permanently marking various points on the reference line further savings in time can be effected. For example a permanent point can be marked on the reference line representing a fixed metal and current density. This point can then be connected to any thickness to give the plating time. This is illustrative of the special conditions to which the chart may be adapted.

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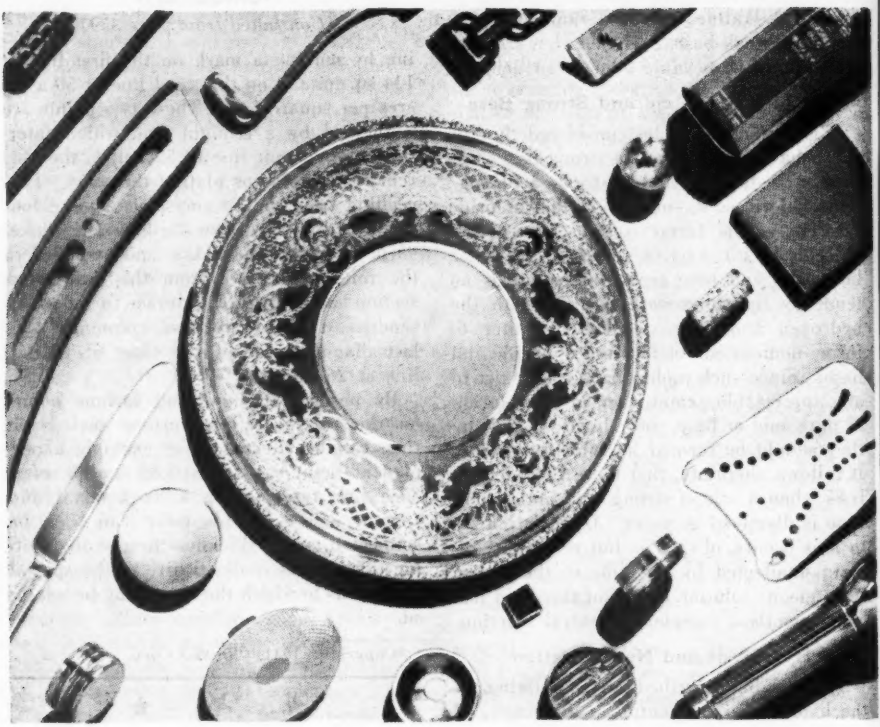
(*Continued on page* 370, *first column*)



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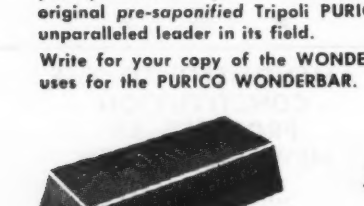

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AES RESEARCH

Progress Report No. 1

Project No. 2

ANALYSIS OF IMPURITIES IN PLATING BATHS

PARTIAL BIBLIOGRAPHY BY
G. Frederick Smith
University of Illinois and
Frederick Duke
Chemical Laboratory, Princeton, N. J.

THIS bibliography is a selected list of references to modern methods of isolating and determining metallic impurities. Those references have been chosen which describe procedures most adaptable to nickel plating baths. The literature contains few modern adaptations of these methods to the specific problem; therefore, these remain to be worked out. The most useful of all references is a book which should be in the hands of anyone working on this problem: E. B. Sandell, *Chemical Analysis*, Vol. 3 "Colorimetric Determination of Traces of Metals." Interscience Publishers, Inc., New York, 1944. No references to the effect of impurities are included; the list is purely analytical.

There are doubtless omissions in this bibliography which will be noticed by interested readers. The compilers urge that such omissions be called to their attention, since a complete and final bibliography is to be published at a later date.

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G. Lead

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(b) H_2S precipitation.

1. I. T. Rosenquist, *Am. J. Sci.* **240**, 359 (1942).

(c) Electrolytic

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1. I. H. Rosenquist, *loc. cit.*

(e) As phosphate.

1. L. T. Fairhall and R. G. Keenan, "A Rapid Method for the Microanalysis of Lead," *J. Am. Chem. Soc.*, **63**, 3076 (1941).

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II. Methods of Determination.

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H. Manganese

I. Separation from interferences.

1. E. B. Sandell, *Chemical Analysis*, Vol. 3, "Colorimetric Determination of Traces of Metals," p. 312. Interscience Publishers, Inc., New York, 1944.

II. Methods of Determination.

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2. M. B. Richards, "Colorimetric Determination of Manganese in Biological Material," *Analyst* **55**, 554 (1930).
3. H. H. Willard and L. H. Greathouse, "Colorimetric Determination of Manganese by Oxidation with Periodate," *J. Am. Chem. Soc.* **39**, 2366 (1917).

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I. Separation from interferences.

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II. Methods of Determination.

1. H. Cowling and E. J. Miller, "Determination of Small Amounts of Zinc in Plant Materials," *Ind. Eng. Chem., Anal. Ed.* **13**, 145 (1941). Dithizone method.
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AMENDMENTS TO THE CONSTITUTION PROPOSED BY NEWARK BRANCH

(*Continued from page* 365)

Sec. 4: Sustaining Members: Any firm or person directly interested in the electroplating industry and the aims and welfare of this Society, may upon the contribution of not less than $ per year, become a sustaining member. The acceptance of such contribution by a majority vote of the Executive Board shall constitute membership. Sustaining membership shall terminate when contributions have ceased for one fiscal year. All funds received from Sustaining Members shall only be used for investigation of problems and processes directly related to research in the art and science of electroplating or any of its allied arts. The names of Sustaining Members shall be published each year in the Proceedings. Sustaining Members shall be entitled to receive copies of the MONTHLY REVIEW, Annual Proceedings and any literature pertaining to the advancement of the art of electroplating or allied arts, issued by the Supreme Society.

Note: We recommend that a one hundred dollar ($100.00) annual contribution be the minimum amount to qualify for Sustaining Membership.

Branch Societies
Part 2 — Article 2

Sec. 1. Classes: The membership shall consist of two (2) classes — Active, Honorary.

Sec. 2. Active Members: These shall consist of any person who is directly connected with the electroplating industry and who will pledge to support the aims and welfare of this Society. He may also be required to pass such examination in the deposition of metals as may be deemed advisable by the Branch. Applications for membership shall be approved by a majority vote of the Branch Board of Managers before being submitted to the Branch for voting. Applications must receive a majority vote at a Branch meeting to be elected to membership.

Sec. 3. Honorary Members: Honorary Membership may be conferred by a majority vote of the Branch upon those whose knowledge and services have added to the welfare of both the Branch and the Supreme Society.

Sec. 4: Omit.

Sec. 5 to be 4, 6-5, 7-6, 8-7, 9-8, 10-9, 11-10, 12-11.

Part 1 — Article IV

The following qualifications shall determine eligibility to election as a Supreme Officer:

1) Active Member in good standing.
2) Foreman, Supervisor, Chemist, Metallurgist, or Executive actively engaged in electroplating.

Should the status of a Supreme Officer change during his term of office, he shall complete his term of office.

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Deoxylyte—Counteracts the alkalinity of the final rinse, leaving the surface in the proper condition for painting.

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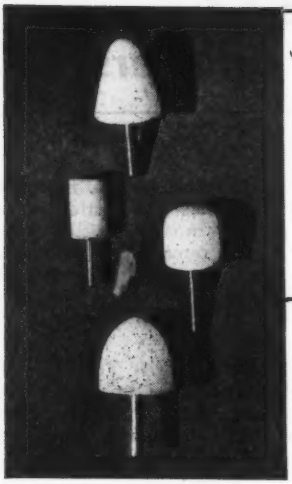

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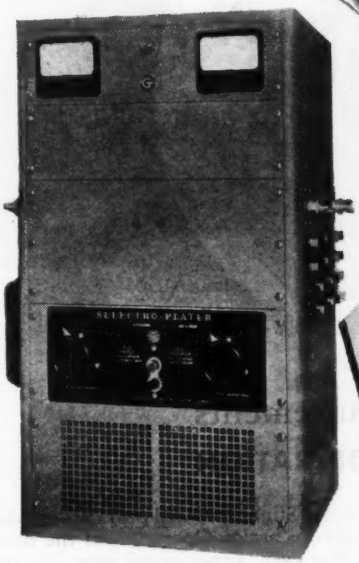

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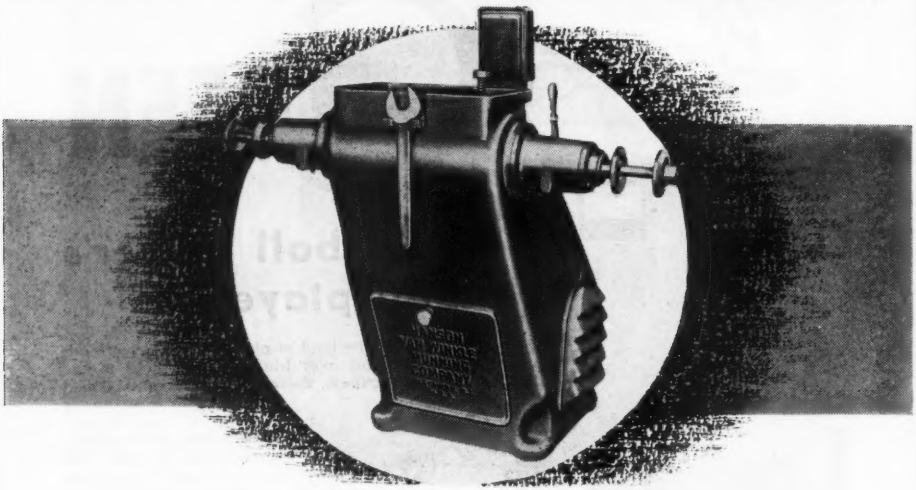

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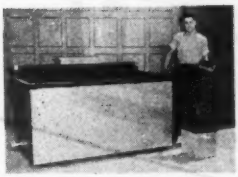

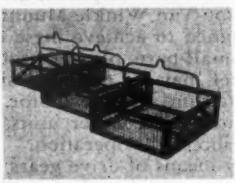

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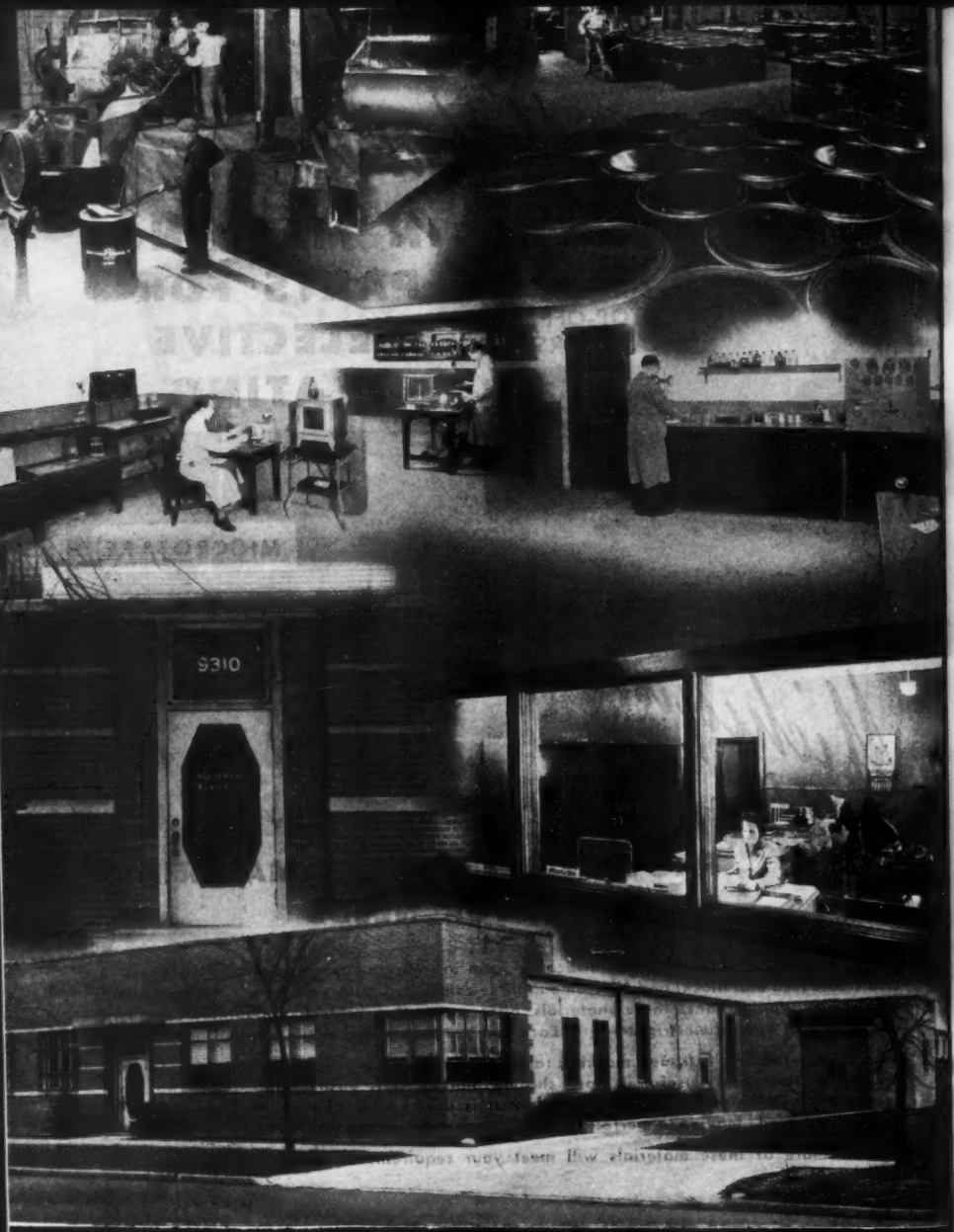

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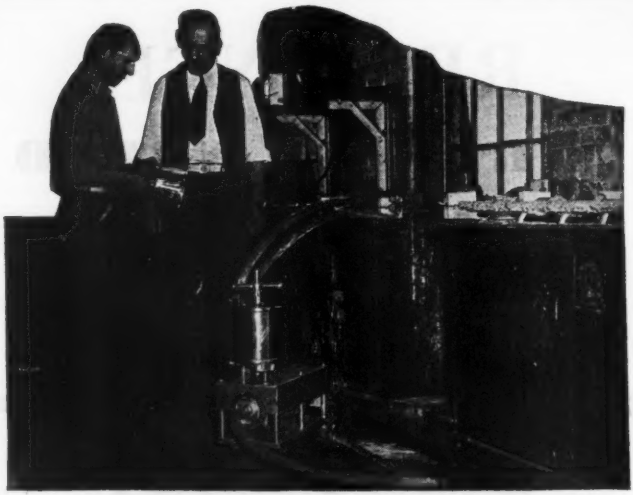

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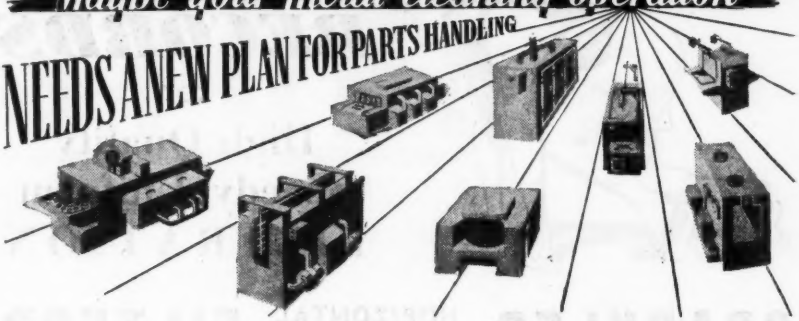

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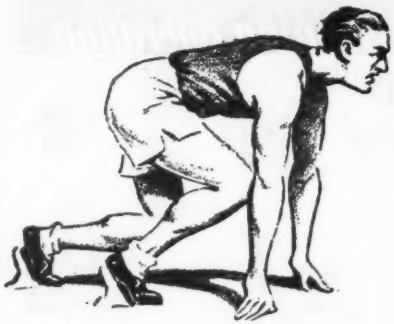

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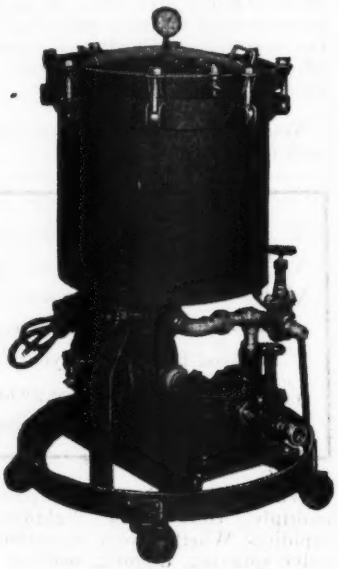

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LISTER AVENUE, NEWARK 5, N. J.

"WARPAINT"

Is our Business Today . . .

Post-war thinking is a healthy thing as long as it's kept in the back of our minds and OUT of our present production lines. It would be foolish NOT to think about making our post-war products with as great an "eye appeal" as possible. But the eye appeal that really counts these days is an olive drab or other war finish.

Here at M&W we are producing many kinds of industrial finishes built to Government specifications. M&W's paints, lacquers and enamels are being used today on shells, bombs, hand grenades, aircraft, radios, torpedoes, and a host of other vital war materiel. They're doing a job which helps in a small way to "finish off" our enemies.

Let's all pull for Victory *now*. When the time comes for producing your post-war product — give it an M&W finish for eye appeal.

MAAS & WALDSTEIN COMPANY, NEWARK, N. J.

PRODUCERS OF LACQUERS, ENAMELS, SYNTHETICS AND SPECIALTY FINISHES FOR ALL PURPOSES

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WITH **MEAKER EQUIPMENT**

You are ready for Quick Conversion to Peacetime Decorative Plating . . . . .

Choose the plating equipment you install for war work with an eye on quick conversion to peacetime decorative plating.

MEAKER Full Automatic Machines are most flexible, and can be readily adapted to handle different size racks through an entirely new sequence. Transfer mechanism may be moved or made wider, or "lift" increased at a nominal expense. Unit may be lengthened by adding new sections, without junking any considerable part of the old machine.

MEAKER Equipment is simple, compact, accessible, and oversize to stand continuous operation.

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MEAKER EQUIPMENT

- Straight-a-way Full Automatic Plating Conveyors
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- Semi-automatic Plating Machine
- Specially-designed Plating and Processing Machines
- Strip Steel Galvanizing Lines
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- Motor Generator Sets · Copper Oxide Rectifiers

GEORGE L. NANKERVIS CO., DETROIT — DISTRIBUTOR

INDUSTRY NEWS

A. J. Maynard

In Memoriam

Al devoted his entire career to the electroplating industry. He was a faithful member of the Hartford Chapter in which he held office for many years. He was employed during the early days of his career at the New Departure plant, Bristol, Conn. He was the founder of the Plainville Electro-Plating Company and managed it for many years. The last 10 years of his life were spent as Service Engineer for MacDermid, Inc., Waterbury, where he was employed at the time of his untimely death. The industry and the Hartford Chapter in particular suffered a great loss, and will always remember "Al" as a man devoted to his work and one who gave unstintingly of his services whenever anyone came to him with their troubles.

F. W. SMITH, *Secretary*

Frank Hanlon Passes

Just as the last forms for the April REVIEW were going to press word was received from Jim Hanlon that his brother Frank passed away Tuesday, March 27th. Frank had a stroke and passed away within five minutes after he reached the hospital. The funeral was scheduled for Friday, March 30th.

The legion of friends who knew Frank will be distressed at his passing but take comfort in knowing his passing was without pain. More details of Frank's long career and participation in the A.E.S. will be carried in the May issue of the REVIEW.

Mechanical Finishing, Plating Expert

Well established job plating company in the middle west would like to contact a man of unlimited experience in all phases of plating and mechanical finishing such as ball burnishing, Roto-Finish tumbling or lupmatic process. Knowledge of bulk plating of parts in chromium and other metals very desirable. Excellent post-war possibilities. Advise us of your experience, age, salary expected, etc. MONTHLY REVIEW, Box 4 M.R.

Sheehan Passes

The Milwaukee Branch grieves the death of Mr. Richard Sheehan, one of its most active and popular members. Mr. Sheehan was superintendent of the plating depart-

ment of the Cutler-Hammer Company of Milwaukee. He will always be remembered by the Milwaukee Branch as promoter of the best interests of the society.

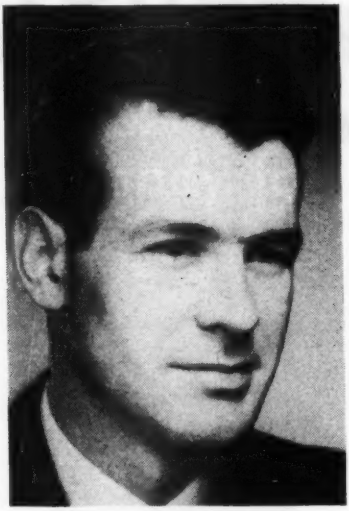
M. C. Boss

Optimus Equipment Appoints M. C. Boss

The Optimus Equipment Company, Matawan, N. J., manufacturers of mechanical metal washing and drying equipment, has announced the appointment of Marcel C. Boss, a Chief Engineer in charge of design and production operations.

Mr. Boss, who has had a long and varied experience in the manufacture of use of such equipment, was born in Paris, and was educated at the famous French engineering school, Ecole Centrale de Paris. Formerly an engineer with Carrier Engineering Company, in London and Paris, Mr. Boss established his own organization, Mabor Company, in Paris in 1930, specializing in the manufacture of metal washing and drying equipment. Such machines were installed in a wide number of important manufacturing locations throughout northwestern Europe, especially in munitions and aircraft plants.

In 1942, Mr. Boss came to the United States, at which time he joined the staff of Hanson-Van Winkle-Munning Company as an engineer. In 1944, he became a member of the executive staff of The Optimus Equipment Company in which capacity he has been active in developing the design of an increasing number of new types of equipment.



J. J. Duffy, Jr.

Pennsalt Appoints Duffy

The appointment of Mr. J. J. Duffy, Jr., as Assistant Manager of Sales of the Pennsylvania Salt Manufacturing Company, Philadelphia, Pennsylvania, has just been announced by Mr. George B. Beitzel, Vice President in Charge of Sales.

Mr. Duffy, a graduate Chemical Engineer, has been associated with the Company since 1937. After completing the Company's Student Training Course in 1939, he was assigned to the Special Chemicals Division and, for the next three years, served as Sales-Service Engineer for that Division in the New York State area. He was then called to the Philadelphia office in 1942 to assist Mr. Wm. P. Drake, Manager of Sales, as Development and Service Engineer on the new products of the Special Chemicals Division made necessary by the wartime needs of the industries served by that Division.

In his new capacity, Mr. Duffy will assist Mr. Drake in supervising the activities of the Special Chemicals Division's field men.

Wanted

Will pay liberal salary for good job shop electroplater who is thoroughly capable and has had experience in directing plating operations and soliciting business. *Monthly Review*, MR-A4.

Despatch Oven Opens Chicago Branch Office

The Despatch Oven Co. has just opened a new sales and field engineering office in suite 1334 La Salle-Wacker Building, 221 North La Salle Street, Chicago 1, Illinois. In this new Despatch branch office is an engineering staff which is considered to be one of the most outstanding in the nation. No man in the office has had less than eight years of experience, and some of them have had up to 23 years of practical experience in designing industrial ovens and in making plant layouts that incorporate not only ovens, but auxiliary equipment such as cleaning and washing machines, bonderizing systems, spray booths, air conditioning systems, conveyor systems, and the like. Their total experience is just under 70 years, and this figure does not include the experience of any of the draftsmen.

These men have had great experience in finish baking, and can be of great help to any of your electroplaters who are contemplating doing the entire finishing job in their shops, or to those who now have complete facilities, but are planning to amend their finishing departments to meet the greater postwar production requirements.

$1000.00 In Prizes For Papers On Resistance Welding

PRIZE CONTEST RULES

In order to encourage the preparation of outstanding papers dealing with resistance welding subjects, the Resistance Welder Manufacturers Association, Philadelphia, Pa., has for several years conducted a prize contest, the awards for which are announced annually at the fall meeting of the American Welding Society. The scope of this contest has recently been increased, bringing the total amount of the awards up to $1000. The prizes are to be awarded as follows:

One prize of $500 for the best paper emanating from an industrial source, consulting engineer, government laboratory, or the like, in which the major portion of the subject matter is concerned with design for resistance welding. This includes design of component parts to accomplish the maximum economy and welding quality and also details of procedure, work preparation and work handling, etc.

Two prizes of $200, each, will be awarded to the authors of two papers, not primarily concerned with design, which, in the judgment of the Board of Awards, are the greatest original contributions to the advancement and use of resistance welding. One of these two prizes shall go to the best paper emanating from a university source—that is, either an instructor, student, or research fellow at a recognized university. The second of these two prizes shall be awarded for the best paper emanating from an industrial source.

A fourth prize of $100 will be awarded to the author of the best remaining paper, which may fall in any of the three groups mentioned above.

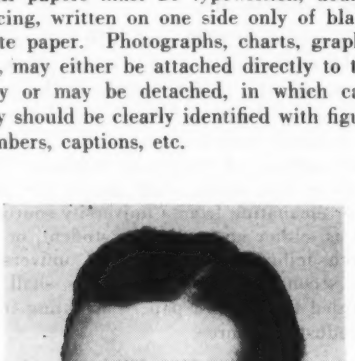
The contest is open to anyone, without restriction, from the United States, its possessions and Canada. It is also open to any member of the American Welding Society in any grade from any place in the world. The contest is considered as having opened September 1, 1944, and will close on midnight, July 31, 1945. Papers which are to be presented at the Annual Meeting of the American Welding Society in October may also be entered in this contest, in which case a draft or copy of the paper must be filed with the American Welding Society not later than July 31, 1945.

All papers submitted in the contest become the joint property of the R.W.M.A., and the American Welding Society, who will retain all rights thereto. The American Welding Society will appoint three judges, who will judge the relative merits of the various papers submitted and make the awards accordingly. The decision of the judges will be final.

For the author or authors to be eligible for this award, the paper shall describe clearly original work done by them or under

their supervision on resistance welding in any of its aspects by any method or process. The paper shall be a full disclosure of the subject. The paper shall contain no statement which is unethical advertising or sales promotion. The paper may contain statements of fact, including the names of either individuals or organizations of any kind, commercial designations, trade names, etc. The minimum length requirement is 2500 words.

All papers must be typewritten, double spacing, written on one side only of blank white paper. Photographs, charts, graphs, etc., may either be attached directly to the copy or may be detached, in which case they should be clearly identified with figure numbers, captions, etc.



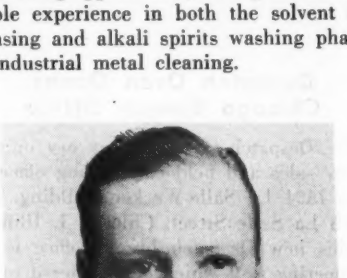
J. N. Cooper

Detrex Shifts Cooper To New England

As part of the expansion program of the Alkali Division of Detrex Corporation, Detroit, Joel N. Cooper, will transfer from Michigan to the New England states, where he will supervise sales of alkali and emulsion cleaning materials. This promotion becomes effective immediately, according to L. Camel, General Alkali Sales Manager.

Detrex Corporation manufactures alkali and emulsion cleaning compounds, solvent degreasers, metal parts washers, chlorinated solvents, dry-cleaning and oil-extraction equipment.

Mr. Cooper, whose headquarters will be in Meriden, Connecticut, started with Detrex in 1940 and was active in the Industrial and Drycleaning departments prior to his connection with the Alkali division. He will take East knowledge of a wide range of cleaning applications, having had considerable experience in both the solvent degreasing and alkali spirits washing phases of industrial metal cleaning.



A. R. McNeil

MacDermid Inc. Appoints McNeil

MacDermid Incorporated of Waterbury, Connecticut, recently announced the appointment of Arthur R. McNeil as Technical Sales Engineer for Southern Connecticut.

Mr. McNeil is in his second year as President of the Bridgeport Branch of the American Electroplaters Society and is a member of the Electro Chemical Society.

Mr. McNeil started his career of plating and polishing in the Underwood Elliott Fisher Plant in Bridgeport leaving there to go to Contract Plating Company in Stratford where, under the expert tutelage of Ray O'Conner, he became Plant Superintendent. After twelve years at Contract Plating Company, he worked at Bridgeport Thermostat as Finishing Supervisor.

Because of this excellent background, Arthur McNeil is well qualified to service the metal cleaning compounds Mac Dermid Incorporated manufacture as well as engineer and install complete metal finishing plants.

New Machine & Process For Wire Plating

Mr. Joseph B. Kushner, Metal Finishing Engineer, 233 W. 26th St., N. Y. C., announces the development of a new process and machine for the high speed plating of wire, metal ribbon and the like. Based on new techniques, the machine and process is capable of handling wire from .0025" to light cable at speeds of 150 to 750 feet per minute and higher. The deposits of metal can be made to close specification as regards thickness and weight. The overall length of the machine may run from 18 to 36 feet long, depending on the amounts and number of electrodeposits required. For example, a machine capable of plating a 2% by weight deposit of gold on fine silver wires at a speed of 300 ft. per minute, is only 22 feet long. The machine, which runs about 30" wide is capable of handling 12 lines of wire at a time each receiving a uniform plate of metal. All plateable metals are capable of being handled by the machine.

In another variation, a machine designed for plating small parts, can gold and silver plate radar parts to 20-40 msi specifications at such rates and with such a minimum amount of labor involved as to offer definite advantages over barrel plating techniques, particularly in view of the more uniform deposits of metal produced by the machine. High speed zinc plating of small metal parts such as 30 and 50 caliber cartridge cases, brass plating of electrical parts, etc. are some of the many possibilities offered by the machine and process. Applications for patents have been made. Inquiries with regard to war and postwar uses for the machine and process are cordially invited from responsible manufacturers and platers.

Water Soluble Buffing Compounds

After several years of research and practical demonstrations, a line of buffing compounds have been developed that are completely water soluble. E. Reed Burns Mfg. Corporation, with plants in Brooklyn, New York and Middlesex, New Jersey, announce two lines of buffing compounds now in production with this water soluble feature.

This advantage is made possible by the use of some of the new types of wetting agents which cause the usual type grease bond to become completely soluble in water close to the boiling point, eliminating the use of strong cleaners, long soaking and manual scrubbing operations.

In the jewelry and silverware field, a special coloring rouge for both gold and silver has met with almost instantaneous acceptance. This grade is made of the finest obtainable domestic oxides and will produce a high, brilliant, scratchless lustre. It will wash out of recessed and filigree parts without soaking or scrubbing, in plain water at about 200° F. This grade is #7WS, and is in cake form, packaged in a carton 7½" x 2½" x 1½".

The same principal has been applied in the production of tripoli compounds for cutting down all types of non-ferrous metals.

These grades are made of pure tripoli flour, with the grease binder treated the same as in the case of the Red Rouges. There have been several grades so far developed, one for brass, where a dry, high coloring compound required, and others where a heavier cutting, more moist grade is needed. These grades are furnished in approximately 3½ - 4# tubes. The dry grade is #8WS TRIPOLEX, and the faster cutting grade is #15WS.

While these grades so far have met the requirements in the majority of cases, the Reedburns Company is prepared to develop grades in both of these types of material if unusual conditions are encountered which require special formulation.

Further information and samples can be had upon request to the company's main office—40 Withers Street, Brooklyn 11, N.Y.

Electroplating and Finishing Expert

Man, well-versed in problems of electroplating and metal finishing processes. Some one who has sold or serviced materials might have knowledge we need. Real opportunity. Man can be of unusual service on problems in war plants now and postwar work later on. Nationally known company making materials used in processing and maintenance work. Details of age, experience, salary, etc. treated confidentially.

If data indicates necessary combination of experience, interview will be arranged at our expense. Location New York, some traveling. Box 567, Church St. Annex, N. Y. P. O.

Milwaukee Annual Meeting

The Milwaukee Branch of A.E.S. is again holding its annual banquet and educational meeting on Saturday, April 29, 1945, at the Schroeder Hotel.

The following papers are to be given:

Electroplating Technique, by F. Savage, C. G. Conn, Ltd., Elkhart, Indiana.

New Rapid Nickel Plating by Walter Pinner, Houdaille Hersey Corp., Detroit, Michigan.

Finishing of Army Ordnance by J. R. Devlin, Milwaukee Office.

Announcement

Frederick C. Strong III has joined the technical staff of the Enthone Co., as a Development Chemist.

Mr. Strong received his B.A. in Chemistry from Swarthmore College, and his M.S. from Lehigh University.

Before joining Enthone, he was employed with Superior Metal Company, Lea Manufacturing Co., and most recently as an instructor at Wesleyan University.

The Vancoram Review

The Vanadium Corporation of America is resuming publication of their house organ, *The Vancoram Review*, which will be issued quarterly and is being presented in an entirely new and attractive form.

With the new issue, the Vanadium Corporation dedicates the publication as a "practical, impartial aid to the continued advancement and progress of alloys, metals, and allied chemical compounds."

Articles in the current issue cover applications of Vanadium in the aircraft, railroad equipment and cast steel industries; a new graphizing alloy for cast iron; and use of Grainal Alloys for improvement of N. E. specification steels, and in making anchor chains. Special departments are devoted to new products, and abstracts of current literature. Principal products of the Vanadium Corporation and their applications are also listed.

The Vancoram Review is an informative bulletin for those who are interested in the development and application of ferro-alloys, metals, in general, and allied chemical compounds.

New Bulletin

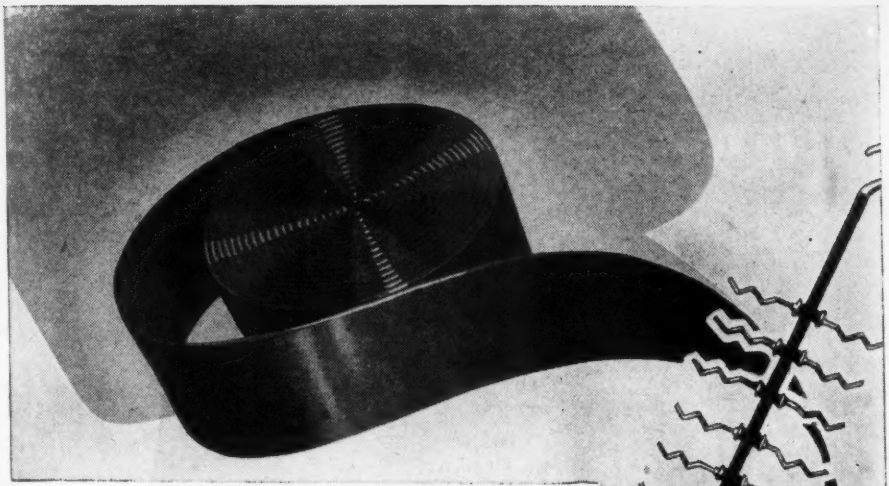
Special Chemicals Co., 30 Irving Place, New York 3, N. Y., announce a new bulletin ready for distribution. The bulletin describes SPEKWITE, a beautiful white finish that is tarnish resisting. Copies will be forwarded free on request.

Henry G. Wall

New Cowles Representative

The Cowles Detergent Company, Cleveland, Ohio, announces the appointment of Henry G. Wall, 128 Westminster Street, Buffalo, New York as Cowles Technical Man to handle the technical service work for their Metal Cleaner Department in New York state.

Mr. Wall, who has recently been honorably discharged from the Army, was educated in Buffalo Schools and Genesee Wesylan. He has covered the New York State industrial field for many years as a technical engineer on surface coatings and finishes. He has also operated a manufacturing business in Buffalo, and has a well rounded technical background which will enable him to render valuable service to the metal working industries.



• Built into Tygon Tape are properties which the experience and "know-how" of top platers everywhere, approve. Here is an insulating tape designed to make plating rack protection simpler, more positive.

It has stretch without snap to make application easy, to assure an even, uniform wrapping tension without entrapped air. Its smooth surface does not "wet" easily, lessens dragout. Its excellent dielectric qualities decrease current losses. Its tough, resilient nature resists mechanical abrasion and impact shocks. And its almost "universal" corrosion-resistance provides real rack protection from chemical attack.

Available at your dealers in convenient 3/4" wide rolls, or write direct.

TYGON TAPE

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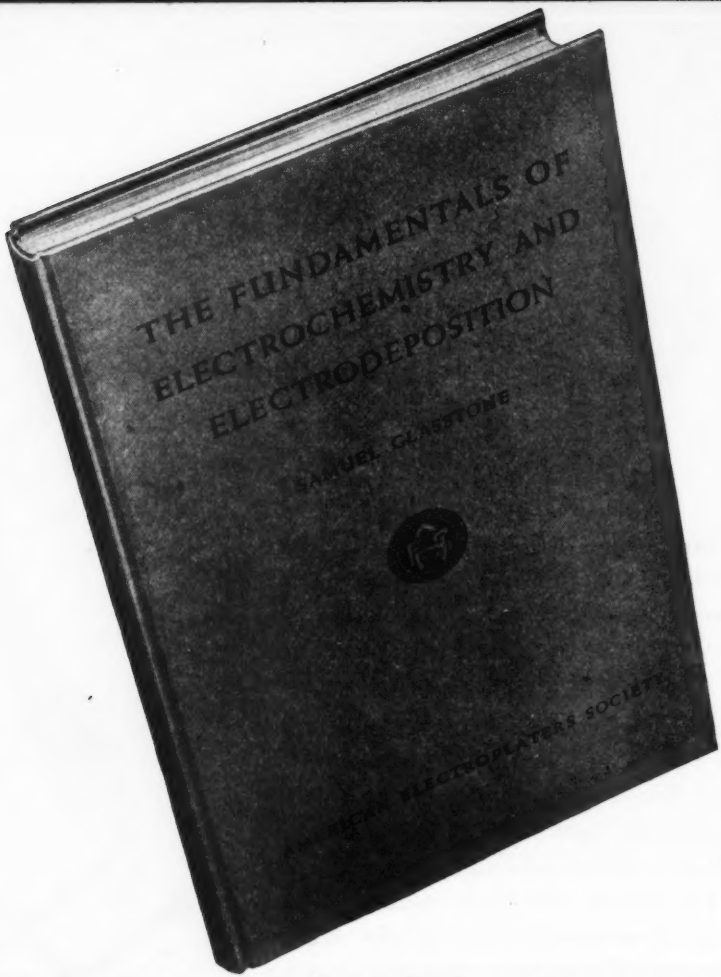

INDISPENSABLE TO *Practical* ELECTROPLATERS

A.E.S. announces publication of "The Fundamentals of Electrochemistry and Electrodeposition" . . . by Samuel Glasstone!

With this announcement, A.E.S. initiates another new, needed, vitally important service. This—and similar manuals to follow—condense into compact, practical handbook form—the authentic essentials of the science of electroplating. Dr. Glasstone's book is a compilation of the much-discussed series of articles which appeared, during the past year in the *Monthly Review*. But the material has been completely revised in the light of latest war-time developments . . . to provide practical, daily usefulness to schools, colleges, and every serious electroplater!

Handsomely printed, richly case-bound, 90 pages 5¼ x 8¼ and priced at only $2.00 per copy, as an educational feature of A.E.S. Send check or money order to National Headquarters.

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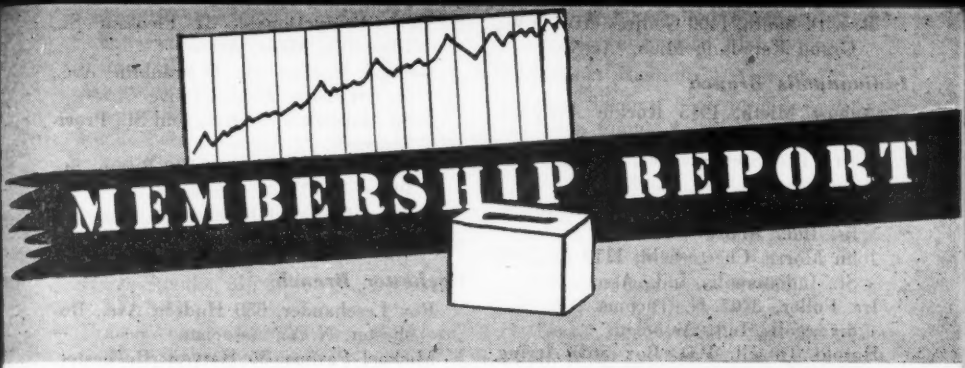

FRANK K. SAVAGE
Chairman, Membership Committee

ELECTIONS

Baltimore-Washington Branch

Floyd Willison, 1408 Second Rd., Baltimore, Md., Associate
John Corden, 1334 Popler Ave., Arbutus, Baltimore, Md., Active
Lawrence Ott, 1209 E. 25th St., Baltimore, Md., Active
Carl Seiler, 208 Old Town Nat'l Bank Building, Baltimore, Md., Associate
Harry Irvin, 98 Dunkirk Rd., Baltimore, Md., Associate
Edward Wallace, 4007 Chesmont Ave., Baltimore, Md., Active

Boston Branch

Lawrence O'Neill, 89 Broad St., Boston 10, Mass., Associate
Yale Greenberg, Key Stone Mfg. Co., 151 Hallet St., Dorchester, Mass., Associate
Harry Levesque, 214 Jefferson Ave., Salem, Mass., Associate
William Bateman, Sullivan Machinery Co., Claremont, N. H., Associate

Bridgeport Branch

Herbert June, 31 Warren St., Stamford, Conn., Active
Edwin Scull, 1031 E. Main St., Stratford, Conn., Active
Robert Plaisted, 17 Nichols Ave., Stamford, Conn., Active
Frank Salvaggio, 48 Charles St., Stratford, Conn., Active
Herbert Runde, 559 Allyndale Dr., Stratford, Conn., Associate
L. Franklyn Richard, 7 Herkimer St., Bridgeport, Conn., Associate

Buffalo Branch

Donald Holt, E. I. du Pont de Nemours Co., Electrochemical Dept., Niagara Falls, N. Y., Associate
John Tinsley, 72 Knox Ave., Buffalo, N. Y., Associate
Leonard Miller, 49 Gittere St., Buffalo, N. Y., Active

Cleveland Branch

Clyde Lowe, 2209 Wyandotte Ave., Lakewood 7, Ohio, Associate
David Green, 4 Greystoke Lodge, Hanger Lane, Ealing W5, London, England
Armand Spencer, Dill Mfg. Co., 700 E. 82 St., Cleveland 8, O., Active
Howard Carrick, General Industries Co., Taylor and Olive Sts., Elyria, O., Active

Dayton Branch

James Richards, Box 553, Vandalia, O., Associate

Detroit Branch

Glen Nelson, 1610 W. Williams, Decatur, Ill., Associate
Constantine Civan, 13302 Arlington, Detroit 12, Mich., Associate
Austin Beebe, Sr., 222 W. Grixdale, Detroit 3, Mich., Associate
Guy Cole, 14166 Penrod, Detroit 23, Mich., Active

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Clarence F. Hapner, 1510 Powers Ave., Grand Rapids 4, Mich., Active
Carl Braden, 221 W. 15th St., Traverse City, Mich., Active
Donald Schantz, 854 Prince St., S.E., Grand Rapids 7, Mich., Active

R. Kirk Smith, 1100 Godfrey Ave., S.W., Grand Rapids 9, Mich., Active

Indianapolis Branch

August Mieth, 1915 Ruckle Ave., Indianapolis, Ind., Associate
Harry Lee Stebbins, 602 Berkley Rd., Indianapolis, Ind., Active
James Botts, 1506 Tabor St., Indianapolis, Ind., Active
John Morris Chesterfield, 1119 E. 22nd St., Indianapolis, Ind., Associate
Ira Fuller, 3707 N. Tacoma Ave., Indianapolis, Ind., Associate
Harold Tossell, P.O. Box 5653 Irving Station, Indianapolis, Ind., Associate

Milwaukee Branch

Jerome Stowasser, 1828 West Brown St., Milwaukee, Wisconsin, Associate

New York Branch

Moe Kanner, Davis-K-Products Co., 114 Lexington Ave., N. Y., Associate
Harry Haines, 88-12 Elmhurst Ave., Elmhurst, N. Y., Active
Joseph Koren, 39 Marcy Place, Bronx, N. Y., Active
Sam Rosenblatt, 23 N. Columbus Ave., Mt. Vernon, N. Y., Associate
Joseph Woodruff, 45 Tehama St., Brooklyn, N. Y., Associate
Leonard Singer, 11-16 44th Dr., Long Island City, N. Y., Associate
Stephen Ferenz, 1188 Fox St., Bronx, N. Y., Associate
Joseph Isaacs, 250 E. 4th St., Brooklyn, N. Y., Active
Frederick Hesch, Reynolds Research, Box 551, Glen Cove, N. Y., Associate
John Melhado, 1936 66th St., Brooklyn, N. Y., Associate
John Palermo, 1633 E. 14th St., Brooklyn, N. Y., Associate
Jack Weiner, 1013 Dumont Ave., Brooklyn, N. Y., Associate
Martin Lapen, 1559 53rd St., Brooklyn, N. Y., Active

Philadelphia Branch

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Thomas Rodgers, 106 Woodside Ave., Narberth, Pa., Associate
Nicholas Beer, 808 W. Erie Ave., Philadelphia, Pa., Active

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Edward MacDonald, 57 Pleasant St., Plainville, Mass., Active
George MacDonald, 2 Franklin Ave., N. Attleboro, Mass., Active
John Marandola, 27 Kinggold St., Providence, R. I., Active
Joseph Matheirin, 120 W. Bacon St., Plainville, Mass., Active
Edward Parker, 1 Richard St., Cranston 10, R. I., Associate

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Michael Pavone, 56 Harvest, Rochester, N. Y., Associate
Frank Schwend, 138 Perrin Dr., Rochester, N. Y., Associate
Paul John Good, Plank Rd., Webster, N. Y., Associate

Rockford Branch

Clifford Anderson, 207 N. Pierpont Ave., Rockford, Ill., Associate
Ellsworth Buddin, Rockford Drilling Machine Co., Rockford, Ill., Active
Walter Carey, 320 N. Rockford Ave., Rockford, Ill., Associate
Dale Chapman, 641 South Avenue, Sycamore, Ill., Active
Charles Devine, 337 Cedar St., Winnetka, Ill., Associate
William J. Faley, 320 Oakwood Ave., Rockford, Ill., Active
Raymond M. Finnegan, 6108 North Second St., R.R. 2, Rockford, Ill., Active
John Fitzgerald, Northern Star Plating and Finishing Co., Loves Park, Rockford, Ill., Active
Stuart Golding, J. L. Clark Mfg. Co., Rockford, Ill., Associate
Wesley Grienpentrog, Northern Star Plating and Finishing Loves Park, Rockford, Ill., Associate
Bert E. Harvey, R.R. 4, Alysure Rd., Rockford, Ill., Active
Martin S. Hillbom, 2215 11th St., Rockford, Ill., Associate
George Johnson, 2238 Broadway, Rockford, Ill., Associate
LeRoy Johnson, 902 Fourth Ave., Rockford, Ill., Associate
G. J. Lehman, 2637 Kensen St., Rockford, Ill., Active
Charles Lewis, 617 Commercial Bank Bldg., Peoria, Ill., Associate
Walter McKay, Associate

Eugene Nelson, Northern Star Plating and Finishing Co., Loves Park, Rockford, Ill., Associate

Albert Onerbey, National Lock Company, Rockford, Ill., Active

Rene Pernot, Northern Star Plating and Finishing Co., Loves Park, Rockford, Ill., Active

Casper Sandehn, Industrial Oil and Chemical Co., P. O. 1573, Rockford, Ill., Associate

Harry Steinke, 315 Julien St., Belvidere, Ill., Active

Frank Weber, 740 Regan St., Rockford, Ill., Associate

San Francisco Branch

Frank De Martini, 2607 E. 23 St., Oakland, Calif., Active

Stanley W. Cole, 322 Monte Vista Ave., Oakland, Calif., Associate

Donald Riding, 310 Tehama St., San Francisco, Calif., Active

Leroy Burley, 1820 Folsom St., San Francisco, Calif., Active

Vincent Whitney, 130 10th St., San Francisco 3, Calif., Active

William Perry, 479 29th St., San Francisco, Calif., Active

Robert Huhre, 1401 King Ave., Napa, Calif., Active

Frank J. Smith, 607 Steffan St., Vallejo, Calif., Active

Carl Mattman, 1863 Egbert Ave., San Francisco, Calif., Active

Fred Herrmann, 1228 Hollister, San Francisco, Calif., Associate

Twin City Branch

Carl Sundquist, 2633 Fourth Ave., South, Minneapolis, Minn., Associate

Mark Murphy, 1048 Aurora Ave., St. Paul, Minn., Active

APPLICATIONS

Baltimore-Washington Branch

Walter Teller, 716 S. Port St., Baltimore, Md., Active

James Pace, Box 631, Havelock, N. C., Associate

Solomon Berman, 411 N. Exeter St., Baltimore, Md., Active

Boston Branch

Guy Gage, 818 Montello St., Brockton, Mass., Active

John Nestor, 31 Waterhill St., W. Lynn, Mass., Active

Rudolph Marshall, 316 Shrewsbury St., Worcester, Mass., Active

Bridgeport Branch

Louis Shamas, 755 Broad St., Bridgeport, Conn., Associate

Joseph Ganin, 25 Taft Ave., Bridgeport, Conn., Associate

Howard Beers, 46 Crescent Dr., Devon, Conn., Associate

Cleveland Branch

William Jenkin, 10418 Sandusky Ave., Cleveland, O., Associate

Manuel Powell, 12910 Taft Ave., Cleveland, O., Active

R. W. Battenhouse, Master Hardchromers, Inc., 5605 Herman Ave., Cleveland, O., Active

Lorin Correll, The Hoover Co., North Canton, O., Associate

John Henricks, 13474 Edgewater Dr., Lakewood, O., Associate

Dayton Branch

Jay C. Harris, 257 Telford Ave., Dayton, O., Associate

George Nangle, 1015 W. Main St., Springfield, O., Active

Hartford Branch

Anthony Tosicani, 96 Clinton St., New Britain, Conn., Active

Joseph Mortellite, P.O. Box 295, New Britain, Conn., Associate

Milwaukee Branch

Joseph Popovich, 437 South 65th St., Milwaukee, Wis.

Donald Goetzke, 4112 North 24th St., Milwaukee, Wis.

A. C. Van Schelt, Firestone Steel Products Co., 4601 West Lincoln Ave., Milwaukee, Wis.

Newark Branch

James Boitano, R.F.D. 2, Whippany, N. J., Associate

John Dyer, 33 Lelans Ave., Plainfield, N. J., Associate

William Zeuss, National Tool & Mfg. Co., Kenilworth, N. J., Associate

New York Branch

Harry Liebler, I. O. Watchcase Co., Jamaica, N. J., Active

Irving Dobres, Ijay Polishing & Plating Co., N. Y. City, Associate

Victor Alguadick, Precision Electro-Plating Co., New York City, Active

Peter Branton, Precision Electro-Plating Co., New York City, Associate

Walter Monson, Wire rocessing Corp., New York City, Active
Edward McDermott, Sperry Gyroscope Co., Brooklyn, N. Y., Associate

Providence-Attleboro Branch

Michael Bessacine, 251 Potters Ave., Providence, R. I., Active
John Bonette, Progress Jewelry Mfg. Co., 17 Beverly St., Providence, R. I., Active
Harry Holt, 6 Garden St., Pawtucket, R. I., Active
Frank Dounes, 42 Dayton Ave., Hoxie, R. I., Active

CHANGE OF STATUS

Bridgeport Branch

Vincent DeNaples from Associate to Active Membership

TRANSFERS

A. J. Lupien from Detroit Branch to Cleveland Branch
H. Leever from Detroit Branch to Waterbury Branch
F. E. Revell from Detroit Branch to Twin City Branch
H. Bandes from Providence-Attleboro Branch to New York Branch
R. N. Thomas from Baltimore-Washington Branch to Los Angeles Branch
A. T. Leonard from Chicago Branch to Twin City Branch

RESIGNATIONS

Bridgeport Branch
Paul Krouse

New York Branch
Anthony Thomas
William Fischer

SUSPENSION

Dayton Branch
Lloyd Huey
J. E. Ledger

Hartford Branch
William J. Hassley

New York Branch
Joseph Kushner
R. T. Potthoff

DEATHS

Detroit Branch
Henry Horndrop

32nd. PROCEEDINGS

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The American Electroplaters Society

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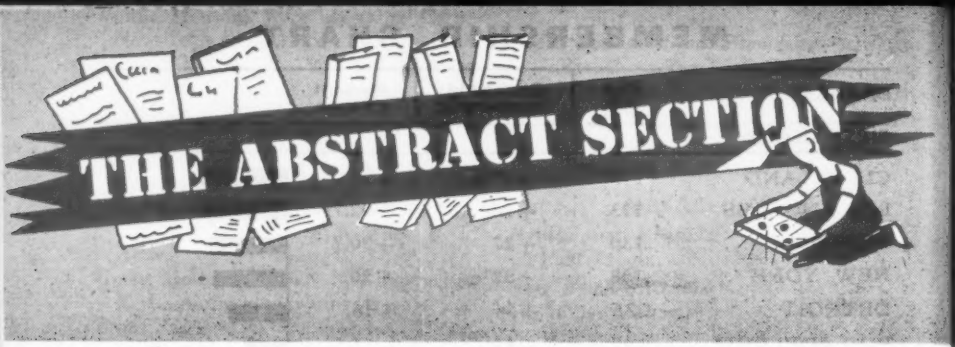
MEMBERSHIP CHART

BRANCH	May 1944	Change in Membership	Percent Change
FIRST GROUP			
CLEVELAND	115	+27½	+23.9
LOS ANGELES	123	+28	+22.7
BOSTON	130	+27	+20.7
NEW YORK	158	+32½	+20.
DETROIT	336	+54	+16.
PHILADELPHIA	138	+16	+11.5
HARTFORD	114	+12	+10.5
ST. LOUIS	111	+11	+ 9.9
WATERBURY	111	+10½	+ 9.4
NEWARK	198	+14½	+ 7.3
CHICAGO	323	+23	+ 7.1
SECOND GROUP			
BRIDGEPORT	102	+15½	+15.1
BALTIMORE-WASH.	107	+16	+14.9
NEW HAVEN	95	+11	+11.5
BUFFALO	80	+ 9	+11.2
GRAND RAPIDS	109	+11½	+10.5
MILWAUKEE	97	+10	+10.3
DAYTON	100	+ 8½	+ 8.5
ROCHESTER	83	+ 7	+ 8.4
TORONTO	109	+ 9	+ 8.2
SPRINGFIELD	79	— 6½	— 8.2
THIRD GROUP			
PROV.-ATTLEBORO	66	+34½	+52.2
INDIANAPOLIS	74	+38	+51.3
TOLEDO	42	+13	+30.9
SYRACUSE	51	+13½	+26.4
JACKSON-LANSING	51	+11	+21.5
TWIN CITY	39	+ 7	+17.9
PITTSBURGH	68	+10½	+15.4
MONTREAL	50	+ 4	+ 8.
LANCASTER	40	+ 2	+ 5.
SAN FRANCISCO	39	+ 1	+ 2.5
AUSTRALIA	51	—	—
ROCKFORD	23	—	—
CINCINNATI	63	— 5½	— 8.7

Membership May 1, 1944 = 3385
Membership April 1, 1945 = 3837

Gain in Membership = 452
Per Cent of Gain 13.3%



WALTER PINNER

Chairman, Program and Educational Committee

Adjustable Racks Speed Aluminum Anodizing

From *Iron Age, Vol.* 154, **19**, Nov. 9, 1944, P. 65.

Adjutable racks designed by employees of the Glenn L. Martin Co., Baltimore, have cut loading time approximately one-half in the anodizing department. Current savings and better utilization of deep capacities are claimed.

Two basic types of racks handle the majority of their production:

1. A center post with spring tension plate at top with a toothed bottom section handles short stampings and tubings.
2. A double hanger with adjustable cross bars with spring tension and notched bottom plate handles long channel sections suspended between two such hangers.

These racks have hooks for making contact attachments to the bus bar frames which are handled by an overhead hoist.

C. W. SMITH

A Sulfate-Chloride Solution for Iron Electroplating and Electro Forming

By R. M. SCHAFFERY and BRUCE W. GONSER. *Metal Finishing,* October, 1944 —pp. 614-616.

A limited amount of experimental work on the electrodisposition of iron and iron alloys has been reported by various investigations in the past. The authors have found a bath which eliminates the principal difficulties ordinarily encountered such as excessive brittleness of the deposit, peeling and cracking, pitting, dark deposits or "burning," insufficient throwing power, insufficient stability for continuous use, and too slow a rate of disposition.

The composition of the bath selected as most likely to succeed where other baths have failed was found to be:

	gm./l.	*oz./gal.*
Ferrous sulfate ($FeSO_4$—$7H_2O$)	250	33.0
Ferrous chloride ($FeCl_3$—$4H_2O$)	42	5.6
Ammonium chloride (NH_4Cl)	20	2.7

Commercial salts are satisfactory for use.

In the sulfate chloride bath it was found that cracking, followed by peeling when poor adherence prevails, may be caused by one of several of the following:

(a) pH too low.
(b) Bath temperature too low.
(c) Current density too great.
(d) Cathode too close to anode.
(e) Too much ammonium chloride in the bath.
(f) The use of certain organic agents.

In electrotyping, it is claimed that a pH as low as 4.0 can be used without peeling if the temperature is held at 105 to 110° F. and the current density does not exceed 50 amps, per sq. ft.

In electroplating, where an adherent deposit is obtained plating conditions can be varied considerably without encountering the problem of peeling and cracking. For this type of work a pH of 3.5 can be used

with the plating bath at room temperature and with current densities up to 50 ampere per square foot. Cathode efficiencies are reported to be above 96%.

R. B. KINNAMAN

Thickness Measurements of Electrodeposited Metals

By RICHARD B. SALTONSTALL. *Metal Finishing*, October, 1944—pp. 606-609; 638-639.

Methods for measuring thickness of electrodeposited coatings have been divided into five general classifications by the author as follows:

1. Direct measurements.
2. Timing processes.
3. Weight operations.
4. Magnetic measurements.
5. Electrolytic tests.

The paper is interesting in that it gives a complete description of each known test under the general classification. The advantages and limitations of each are clearly given.

R. B. KINNAMAN

Determination of Zinc in Cyanide Brass-Plating Baths

By A. S. MICEL and I. O. LARSON. *Ind. and Eng. Chem.* **16**, 165 (1944).

To 10 ml. sample of brass plating solution, add dropwise 10 ml. con. HCl (in hood!), and heat until clear. Cool and carefully add 7 ml. of a mixture consisting of 3 volumes of con. HNO_3 and 2 volumes of con. H_2SO_4. Evaporate to heavy white fumes. Cool the residue, add 1 ml. of 1 to 1 nitric acid, and remove copper by electrodeposition. After the removal of copper, add 3 drops of 5% ammonium persulfate solution, and evaporate to 25 ml. Cool, rinse beaker walls, add 2 g. of sodium pyrophosphate (to form the ferric iron complex), and finally, 5 ml. of concentrated ammonia. The solution should be alkaline; if not, make just alkaline to phenolphthalein. Neutralize with 1 to 1 sulfuric acid and then add 6 ml. in excess. Warm the solution to 40-45° C. Start vigorous mechanical agitation. Add 3 drops of 1% diphenyl benzidine in syrupy phosphoric acid and 3 drops of 0.2% potassium ferricyanide, to form the violet oxidation product of diphnyl benzidine. Titrate to a permanent endpoint, using a 0.025 molar solution of potassium ferrocyanide containing 0.3 g. of potassium ferricyanide per liter. The ferricyanide in the titrating solution is essential. Small amounts of lead, arsenic, antimony, tin, aluminum, magnesium, calcium, and silicate as well as of several commercial alkaline cleaners do not interfere. Pickling inhibitors prevent the development of color and destroy the endpoint. This procedure permits the determination of copper and zinc in one vessel, requiring an average of 1½ hours.

ERNEST H. LYONS, JR.

The Nitriding of Carbon Steels as a Substitute for Anti-Corrosion Films

By E. M. ZAMANSKII, *Vestnik Khar'kov Elektromekh. Zavoda*, **1940**, No. 3, 21-4; *Khim. Referat. Zhur.* **4**, No. 6, 137-8 (1941); *Chem. Abstracts* **37**, 6631 (1943).

Nickel plating can be replaced by the nitriding of steels, for corrosion resistance. Details are given of the nitriding of carbon steel, cast iron, and cast steel.

ERNEST H. LYONS, JR.

A Simple Volumetric Method for Estimation of AG CN Electroplating Solutions

By J. N. GREGORY. *J. Council Sci. Ind. Research*, **16**, 185-90 (1943).

A satisfactory determination of Ag is obtained by titration with $AgNO_3$ solution (0.2-0.05 *N*) with K_2CrO_4 as indicator. The solution is adjusted to approximate neutrality just before the endpoint (in the absence of CO_3 ion) by acidifying and adding excess MgO or $CaCO_3$. CO_3 ion is preferably removed before titration by precipitation with Ba, excess of which is removed with Na_2SO_4, and the pH is adjusted with H_3BO_3.

J. F. KEFFORD, *Chemical Abstracts*

Protecting Zinc Alloy Articles Against Intercrystalline Corrosion by Electrogalvanizing

L. KOCH. *Metallwirtschaft*, **21**, 767-60 (1942); *Chem. Abstracts*, **38**, 919 (1944).

Fine-grained zinc deposits .0008-.0012" thick give effective protection against corrosion to zinc die castings. Coarse-grained, more-porous deposits require 3 to 4 times that thickness. Polishing the electroplate improves the protection, especially with coarser deposits. The method is considered to be much superior to chemicals dips or lacquering.

ERNEST H. LYONS, JR.

DR. GEORGE DUBPERNELL

High-Frequency Induction Heating

Frank W. Curtis — 235 pages. Published by McGraw-Hill Book Company, Inc., 1944. Price $2.75.

This is a new book on a subject of timely interest. It offers the user of high-frequency induction heating equipment basic technical application details, without going very deeply into the theory of the method or the design and construction of the apparatus involved. In accomplishing this purpose, very profuse use is made of photographs and line drawings. About half of the space is devoted to these illustrations of equipment and how it is used. There are 249 figures for the 235 page book.

The first chapter on the Principles of Induction Heating seems exceptionally clear and understandable. This provides a valuable and satisfactory introduction to the subject, without entering into any mathematical theory or details unimportant for the purpose of the book. The next chapters describe Types of Induction-Heating Equipment and Design of Induction-Heating Coils. Brazing, Soldering and Joining are covered in chapter four, and are of special interest. Hardening and Heat-Treating are described in chapter five, and constitute the most important application. There are many noteworthy advantages to this method of hardening, in fact twenty-one are described at the end of the chapter. The reviewer is much impressed with the speed of the method, lack of distortion, oxidation and warping, and greater hardenability. A disadvantage is the complicated and expensive apparatus required.

The Fixtures for Induction Heating are described in chapter six. Chapter seven covers Miscellaneous Induction-Heating Methods. Of special interest is the flowing of tin plate on continuously electroplated iron strip, described on pages 185-189. The tin is dull gray and rough as deposited but by passing through an induction-heating coil the granular surface is transformed into a smooth, mirror-like surface, suitable for the production of tin cans and other purposes. This permits the use of only about one-third the quantity of tin used in hot tinning.

Additional chapters cover Designing for Induction-Heating and Dielectric Heating. This last chapter on the direct heating of non-metallic materials by exposure to a high frequency field describes a development which has been increasingly applied in practice the last few years, and would seem to warrant a more detailed description. The author's experience would appear to relate mainly to the handling of metals, and the brief chapter on dielectric heating was included mainly for the purpose of showing the differences between these two methods of heat transfer or generation.

A brief but apparently satisfactory index is included. The book as a whole appears somewhat too brief and general in its treatment of the subject for some purposes, but it is difficult for the reviewer to appraise this point, as he has had almost no experience with this type of equipment.

(1) **The Fundamentals of Electrochemistry and Electrodeposition, by Samuel Glasstone, 90 pages, $2.00.**

(2) **Electroplating and Anodizing, by J. Rosslyn, 224 pages, $2.50.**

(3) **Principles and Applications of Electrochemistry, Volume I Principles. H. Jerman Creighton, Fourth edition, 477 pages, $5.00.**

(4) **An Introduction to Electrochemistry, by Samuel Glasstone, 553 pages, $5.00.**

(5) **Modern Metallurgy for Engineers, by Frank T. Sisco, 432 pages, $4.50.**

(6) **Standard Hankbook for Electrical Engineers, Edited by A. E. Knowlton and R. M. Shook. 2303 pages, $8.00.**

(7) **How to Understand Electricity, by A. Frederick Collins, Revised edition, 326 pages, $.69.**

(8) **Commercial Methods of Analysis, by Snell and Biffen, 753 pages, $6.00.**

(9) **Hardness and Hardness Measurements, by Samuel R. Williams, 558 pages, $7.50.**

(10) **Commercial Waxes—Natural and Synthetic, by H. Bennett, 583 pages, $11.00.**

(11) **32nd A.E.S. PROCEEDINGS, 6½ x 9¼ cloth, 279 pages, $5.00. Contains all technical papers and discussion presented at 32nd Annual Convention.**

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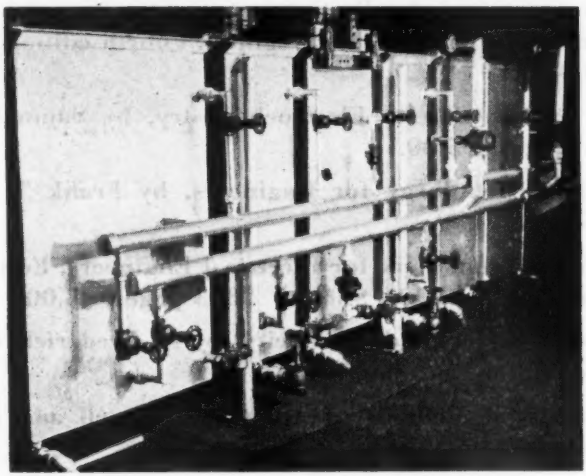

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LANCASTER BRANCH

The Lancaster Branch of the A.E.S. met this evening at 8 o'clock. The minutes of the last meeting were read and approved. The secretary read the various reports of the Research Committee.

The President appointed the following nominating committee: N. Gilbert, Chairman, H. L. Hovis, Clay Brubaker.

The following committee was appointed to make arrangements for our annual meeting in May: T. Schwalm, Chairman, Clay Brubaker, W. H. Fordney.

Owing to the sudden illness of the speaker scheduled for this meeting, a period of discussion was held on shop problems. After the discussion two films were shown "The Birth of the B-29" and a late "War Communique." Both films were enjoyed very much.

The meeting was adjourned at 9:45 o'clock.

WILLIAM H. FORDNEY, *Secretary*

MILWAUKEE BRANCH

The Milwaukee Branch held its regular meeting March 6th, at the Wisconsin Hotel.

After a short business session the meeting was turned over to Mr. Geissman who introduced Dr. Walter Meyer of the Enthone Co.

As usual Dr. Meyer's talk was very informative and interesting. His main topic was on plating of aluminum. He explained in detail his process of predipping the aluminum, then plating on the immersion deposit. He talked about the corrosion resistance of plated parts. The difficulties encountered with some aluminum alloys were brought to light.

Dr. Meyer ventured from his main topic to inform us of some new and interesting developments. Although the meeting adjourned fairly early many members stayed for the informal discussions with Dr. Meyer being the center of information. No one who attended this meeting went away disappointed.

JAMES DURNFORD, *Secretary*

NEW YORK BRANCH

New York held its Educational Meeting at the Hotel Pennsylvania on February 23, 1945. President Maher called the meeting to order at 8:30 P.M.

The minutes of the meeting of February 9, 1945 were accepted as read.

There was one application for membership, that of Joseph Woodruff.

Communications received from Dr. Ferguson of the Research Committee relative to his report on Methods of Measuring Plating Adhesion and Mr. Candee advising the membership that the O.D.T. has not given permission to the society to hold the 1945 convention at Pittsburgh.

Under Unfinished Business, President Maher appointed a committee to organize

soliciting of funds for the Research Committee from the Metropolitan New York area.

Mr. Edward Rinker, librarian, then introduced Dr. Saltonstall, Technical Director of the Udylite Corp., who presented a most interesting paper on "Bright Nickel Plating" for which he was accorded a rising vote of thanks.

Meeting adjourned at 10:30 P.M.

GEORGE SCHORE

NEW YORK BRANCH

New York Branch held its Business Meeting on March 9, 1945. The meeting was called to order at 8:30 P.M. by President Martin Maher.

The minutes of the meeting of February 23, 1945 were approved as read.

The Research Fund Committee reported that it was busy with a plan for organizing the soliciting of funds.

Under Unfinished Business, the membership discussed problems to be presented to the Research Committee for its consideration. There were many suggestions.

George Hermann presided under Good and Welfare.

Question: Has any one information on what is being done on Electro-Static Painting?

Answer: Article covering this in February issue of *Industrial Finishing* also report given in Society Proceedings of the 1942 convention.

Question: What is a good etch for 14K gold for microscopic examinations?

Answer: There were many suggestions but no one had experience of this type. New York Branch would like to hear from other branches on this.

Meeting adjourned at 10:00 P.M.

GEORGE SCHORE

WATERBURY BRANCH

Waterbury Branch was indeed fortunate to have Walter L. Pinner give a paper on "New Developments in Nickel Plating" at the meeting held March 9th. Covering in considerable detail work done just prior to shutting off the supply of nickel for civilian plating, Mr. Pinner told how they developed the high chloride sulphate bath for plating nickel on bumper bars and similar automobile equipment. Bright to semi-bright deposits were produced at current densities much above those normally used with the Watts solution, saving time, labor and power in plating and producing a deposit which buffed readily to a high luster. This interesting paper was received with close attention by all present, and the question period brought out more valuable data. It is fortunate that this material will be published shortly so that we will have the opportunity to review the subject at leisure.

Jack Hyner reviewed briefly papers on Electrographic Analysis published by the Bell Telephone Laboratories and the *Journal of the Electrodepositors Technical Society*. Bill Starr covered various changes in priorities affecting electroplaters and Henry Strow told us of methods of electroplating steel to provide a stop-off in the process of nitriding.

It was the opinion of everyone that this was one of the outstanding meetings of the year, and it is hoped that we may have the opportunity of hearing Mr. Pinner again in the near future.

SPENCER L. HENN, *Secretary*

TWIN CITY BRANCH

The Twin City Branch of the American Electroplaters' Society met on March 5th at the Hotel Andrews of Minneapolis. President Lindemann called the meeting to order at 7:45 P.M. following our dinner meeting. There were 25 members present.

Following the Secretary's reading on the minutes and stating the branch's financial status which were unanimously approved, Mr. Paul Felt, Membership Chairman, introduced our new members and welcomed them into the A. E. S. Mr. Felt also asked that all of the branch's members keep looking for new members. Mr. J. J. Kehoe was the winner of a free dinner which is given each month by the branch.

With the termination of our business meeting Mr. A. T. Leonard, in the absence of the branch's librarian, Mr. Ralph Bowman, introduced Mr. W. A. Helbig of Darco Corporation who presented a most interesting and informative talk on "The Purification of Plating Solutions by the Use of Activated Carbon." Following Mr. Helbig's talk, Mr. Leonard introduced two members who were visitors to our meeting. They were Dr. Walter J. Meyer of Enthone Company and Dr. Davey of George A. Stutz

Mfg. Co. Dr. Meyer and Mr. Helbig answered several questions which were raised from the floor. With the conclusion of Mr. Helbig's talk, he was given a vote of thanks from the members present.

The meeting was adjourned at 10:30 P.M.

R. L. BUCKLEY, *Sec'y-Treas.*

DETROIT BRANCH

The Detroit Branch of the A.E.S. met at the Hotel Statler on Friday, March 3rd, 1945. President R. B. Saltonstall presided, with 160 members and friends present.

The minutes of the February meeting were read and approved. The following were elected to membership: Guy N. Cole. Active; Glenn A. Nelson, Associate; Constantine Civic, Associate, and Austin H. Beebe, Sr., Associate.

Mr. Harold S. Bedberg came to us by transfer from the Baltimore Branch.

Our Librarian, Mr. Paul Strausser, took charge of the meeting and opened with a movie entitled "Defeat and Victory," which gave us a very vivid picture of the cost of this war in both men and materials.

Following the movie, the speaker, Mr. Walter Pinner, First Vice-President of the Supreme Society, spoke on "High Speed Bright Nickel Plating." As usual Walter came through with a very interesting and informative talk.

The bath finally found to be most satisfactory was a high chloride in combination with sulphate. The bath composition was as follows:

200 grams per liter of nickel sulphate
175 grams per liter of nickel chloride
40 grams per liter of boric acid
Temperature of 115°F.
pH = 1.5

The meeting was adjourned followed by a get-together at which time refreshments were served.

RUSSELL MUNCH

HARTFORD BRANCH

The March open meeting of the Hartford Chapter was held on March 19th, in the ballroom of The Hotel Garde in Hartford. President Art Logozzo presided, and Harold Narcus, guest from the Springfield Chapter, was technical chairman. George Hogaboom was on hand for his monthly feature, "Latest Developments."

The speaker of the evening, L. G. Tubbs, Mutual Chemical Co. presented a fine discussion on Chromic Acid Anodizing. His formulas for calculating concentrations of and additions to the anodizing bath developed considerable interest. The usual question period followed, and Mr. Tubbs did a remarkable job of answering them.

The meeting adjourned at 10:00 P.M. with a rising vote of thanks to Mr. Tubbs for his presentation of such a talk. Attendance 50.

F. W. SMITH, *Secretary*

GRAND RAPIDS BRANCH

The Grand Rapids Branch held its meeting on Friday, March 7th at the Rowe Hotel. The meeting was promptly opened by our President, C. M. Fernekes, who called upon the committee chairmen to give their final report on the Seventh Annual Banquet held in January. All other business was transacted and completed.

Our meeting was then turned over to our speaker, Mr. Herberth Head of the Briggs Manufacturing Company who talked on "Production Anodizing." Mr. Head has had considerable experience in Production Anodizing, being supervisor over all the Briggs subsidiary plants in the various States. Considerable discussion took place regarding the anodizing and Mr. Head was very accommodating in answering and solving all questions that came from the members of the Branch. His discussion of Production Anodizing was well received and appreciated by all present at this meeting and it is felt that a large amount of help was received by those present who are in the field of Anodizing of aluminum.

We also had another speaker, Mr. Don M. Ross of the Northwest Chemical Company whose address was given on "Drawing Compounds." A general discussion took place and a lot of knowledge was obtained by those present through the medium of questions and answer discussions.

Following Mr. Ross' talk, a moving picture "Magnesium from the Sea" was shown.

Refreshments were then served by the Hotel and the meeting was adjourned.

The Grand Rapids Branch held its regular meeting on February 9th, 1945 at the Rowe Hotel, which started promptly at eight o'clock. The meeting was opened by our President, C. M. Fernekes.

This meeting was one of our special meetings for the year and after all business was conducted and reports of committees on the Seventh Annual Banquet were given, Dr. Charles L. Faust, B.S., M.S., Ph.D., took charge and gave us a very well illustrated and entertaining talk on "Electro Polishing." Dr. Faust has been with the Battelle Memorial Institute of Columbus, Ohio and at present is supervisor of the Electrochemical Research, and member of the Board of Directors and publishing committee as editor of the *Monthly Review*, and a member of the Dayton Branch. His many years of continuous research and development experience in connection with metal plating and finishing and electrochemical problems made him a valuable speaker for members of this Branch at our February meeting. The meeting was well attended, not only by members, but many guests and those interested in Mr. Faust's subject and very valuable information and data was gained by those present.

There were three applications presented at this meeting to be voted upon at the March meeting.

There was no additional program scheduled for the evening and the meeting was then adjourned and refreshments served by the Hotel.

C. E. ABEL, *Sec'y-Treas.*

PROVIDENCE-ATTLEBORO BRANCH

The regular meeting of the Branch was held at the Providence Biltmore Hotel on Monday, February 19, 1945. President John T. Henry, after calling the meeting to order, expressed regret over the absence of Charles C. Chace, our secretary, who is temporarily laid up. He also called attention to the fact that the Providence-Attleboro Branch is now at the top of the Third Division in the membership drive, and praised the membership committee for its excellent work.

Since there was no other business, the speaker of the evening was introduced. He was Mr. R. P. Crane of the Lea Manufacturing Company, who spoke on "Burring by Flexible Polishing." After an interesting talk, Mr. Crane was extended a vote of thanks by the members.

ALFRED J. MARSHALL, *Librarian*

INDIANAPOLIS BRANCH

The Indianapolis Branch of the American Electroplaters' Society held its regularly stated meeting February 7, 1945 at the Hotel Riley. A dinner was served at 6:30 P.M. and the business meeting called to order at 8:00 P.M. by our President, A. L. Chesterfield.

The Secretary's and Treasurer's reports were read and approved as read. The committee on the meeting place of the Dayton, Cincinnati, and Indianapolis joint meeting reported that Murat Temple will be available May 19, 1945 and approval for this meeting must be granted by the Office of Defense Transportation. James Botts, John M. Chesterfield, Ira K. Fuller and Harold Tossell were elected to membership.

The speaker of the evening was Mr. B. G. Daw of Lasalco, Inc. He used as his subject "Tumbling Barrels." Mr. Daw told us of his experiences with tumbling barrels and some of the most common troubles encountered. He explained how poor distribution of plate was the result of an overload, the correct amount of work to place in a tumbling barrel and illustrated his talk by use of motion pictures which showed what happened to different sized pieces at various barrel loads and speeds.

Upon completion of his talk Mr. Daw answered a number of questions asked him by the members present.

The meeting was adjourned at 9:45 P.M.

CARL R. MORRIS, *Sec'y-Treas.*

NEWARK BRANCH

The regular meeting of the Newark Branch A.E.S. was held on Friday evening, February 16, 1945, at the Hotel Robert Treat in Newark, N. J. In the absence of our President and First Vice-President, the meeting was called to order by our Second Vice-President, John DeVries at 9 P.M. Other officers present were: George Wagner, Sec'y-Treas.; Horace H. Smith and William Bruhns, Board of Managers.

The minutes of the previous meeting were read and approved.

Communications from: The Research Committee, Thomas A. Edison, Inc.; Dr.

A. K. Graham; Jack Bain and The Technical Societies Council of N. J. were read and placed on file.

The guest speaker for the evening was William Hayford, Jr. of U. S. Rubber Co. His subject was "Brass Plating for Rubber Adhesion." He exhibited numerous samples, brass plated steel to which rubber was vulcanized. The samples were passed through the audience for inspection. He explained that on tests which were made, rubber had the adhesion quality to metal of approximately 600 to 800 lbs. tencil strength when properly Brass Plated or when mounted on 60 to 80% Copper Zinc contents of Brass. Mr. Hayford's paper was turned over to the Secretary for publication in the *Monthly Review*. He was given a rising vote of thanks by the 58 members who attended this meeting.

Meeting was adjourned at 11 P.M.

GEORGE WAGNER, *Secretary*

PHILADELPHIA BRANCH

President Zurbach opened the regular February meeting of the Philadelphia Branch with all officers present and a total of 37 members and visitors present.

Motion—dispense with the reading of the minutes. Carried.

Letter was read from Chas. W. Parker, an English member, expressing a hope and desire to visit the Branch after the present war.

Letter from E. T. Candee, executive secretary, about the refusing of the permit for holding the annual convention in Pittsburgh this year.

Chairman Henry G. Orlik, of the Branch Research Committee, reported progress.

After a discussion, Chairman Verrell, of the Entertainment Committee, was requested to make arrangements for a dinner meeting in April.

Librarian Hirsch reported progress with the Philadelphia Branch A.E.S. Free Library section and requested additional books on Electroplating.

Motion—the bills be paid. Carried.

President Zurbach turned the gavel over to Librarian Hirsch, who introduced the speaker of the evening, Walter Binai, R.C.A., Camden, N. J. The subject, "High Speed Plating of Silver and Acid Copper with Insoluble Anodes."

The speaker had quite a long talk on the use of a separate tank for dissolving the metal and pumping the solution into the main plating tank, using moving cathode rods at rather higher than conventional speeds. There were many questions and answers of interest to the members during the discourse.

The meeting closed with a rising vote of thanks to Mr. Binai.

PAUL MENTZER, SR., *Secretary*

HARTFORD BRANCH

The February dinner and technical session of the Hartford Branch was held on February 19 in Jewell Hall at the Y.M.C.A. in Hartford. Sixteen members were present at the dinner and about sixty members and guests attended the technical session.

George Hogaboom presented his monthly feature "Latest Developments in the Finishing Industry." Technical chairman Ted Voyda then introduced the speaker of the evening, Harold Narcus, Plating Processes Corp., Holyoke, Mass., whose subject was "Plating on Plastics." Harold is well qualified to speak on the subject because of his training and ten years of experience in the field. His talk was timely and well presented. He gave a fine paper on the all-important finishing of plastics at the National Convention at Cleveland, and elaborated on it at this meeting.

Harold pointed out that the expansion of the plastics industry in the postwar period will see a corresponding increase in the demand for plated plastics. For this reason his detailed talk, illustrated with several slides was especially appreciated by those present. Every one took home a clear picture of the processes involved in preparing plastics for plating and the proper procedure for obtaining a good bond of metal to plastics. He ended his discourse by answering many practical questions asked by his interested audience.

FRANK SMITH, *Secretary*

BOSTON BRANCH

The Silver Anniversary Educational Session was opened in the Salle Moderne of the Hotel Statler at 2:30 p.m. on March 3. Mr. George B. Hogaboom was the Chairman of the session. Mr. Arthur Logozzo of the Nutmeg Chrome Plating Co., Hartford, Conn. was the opening speaker on the subject of "Hard Chromium Plating." Mr.

Logozzo gave an excellent talk illustrated with some fine slides, many of which were brand new.

Dr. Ralph L. Lee of the Public Relations Dept., General Motors Corp., Detroit, Michigan, was the next speaker on the subject "Human Engineering." Dr. Lee is one of the finest public speakers it has been our pleasure to hear and his talk was richly illustrated with stories and personal experiences. The manuscript of this talk is being sent to the *Review* and we wish that the parts of the speech which are not in the prepared talk could be in inserted. Dr. Lee really rolled 'em in the aisles.

The third feature of the session was a Question Box at which a group of "experts" was called upon to answer the questions which had been dropped in the question box in the foyer. This panel consisted of Arthur Zavarella, Ralph McCahan, Harold Narcus, Harry Sanders, Wes Cassell, and Art Logozzo, with George Hogaboom presiding. Some of the questions and a condensation of the answers is given. This was a lively and interesting discussion and was finally brought to an end at 5:45 p.m. Boston Branch offers sincere thanks to all concerned in making this educational program successful.

LEONARD A. CHESWORTH, *Librarian*

•

QUESTION BOX

Ralph McCahan — Arthur Zavarella
Harry Sanders — Arthur Logozzo
Wes Cassell — Harold Narcus
George Hogaboom, *Chairman*

1. Has anyone definitely experienced hydrogen embrittlement from plating?

A. This began a spirited discussion in which almost everyone took part. The difference between stress corrosion and hydrogen embrittlement was discussed and also methods for relieving both. It was decided that there was definite embrittlement from hydrogen in some cases but that each instance should be investigated on its own merits and the causes and remedies evolved.

2. What material is best for insulation for inside anodes to be used in gold plating?

A. A high melting Lucite or one of the thermosetting plastics was suggested.

3. What thickness of chromium directly on steel golf clubs is satisfactory for protection?

A. Half a thousandths to a thousandth of an inch was recommended.

4. How can carbon be prepared to take a good copper plate?

A. A sandblasting or similar abrasive treatment was suggested or a solvent clean only followed by a weak hydrochloric acid pickle and rinse. It was emphasized that the bond is merely mechanical. Either acid or cyanide copper may be used.

5. What developments have been made in the field of electropolishing steel other than stainless?

A. Electropolishing of steel is being done on large production war items but details could not be disclosed. The process should have many post-war applications.

6. What is the optimum pH at which to operate a brass solution?

A. If the plating is for color only the range is very wide and offers little trouble. If special properties or alloys are desired the pH control becomes very important and must be adjusted to give the desired composition of plate. Reference was made to the study by Dr. Allen Gray in the 1941 A.E.S. Proceedings.

7. How can the amount of condensate be controlled under the new A.S.T.M. and Ordnance Salt Spray Spec?

A. This is a problem that is giving trouble in many installations. The position of the collectors (height above the bottom of the cabinet), the nozzle, the pressure of air, the temperature of the water column, etc. are all factors that may have some bearing on the amount of condensate.

8. Should the normal current for plating chromium be approached from higher or lower values?

A. Cases were cited where either or both methods are used. The basis metal being plated determines the method of approaching the normal current density to be used.

9. Is the spectroscope likely to be of value for rapid electroplating analysis?

A. This instrument is being used by large laboratories to check metallic contamination of plating solutions and is very rapid and accurate. Quantitative analysis procedures are definitely in use for many purposes but how far the use of a spectroscope for electroplating solutions can be developed is problematical.

10. Is water purified by ion exchangers suitable for salt spray and other laboratory uses?

A. The only uncertainty was whether these resin treatments removed algae and such organic materials—otherwise the water is extremely pure and suitable for the uses asked about.

11. Give some safe and efficient methods for stripping copper from zinc base die castings.

A. The sulfur treatment was suggested and the questioner was referred to the A.E.S. research project on that subject.

12. How does the ferric chloride dip after black nickel plating affect the plate?

A. The dip is supposed to darken the color. It was recommended that the desired color be obtained in the black nickel and that the ferric chloride dip was unnecessary and undesirable.

BALTIMORE-WASHINGTON BRANCH

The March meeting of the Baltimore-Washington Branch was held in Washington at the Kenesaw Apartment Dining Room on Wednesday, March 7th.

Mr. Albert L. Fry, Master Mechanic of the Plating and Polishing Shop, Washington Navy Yard was Chairman of the Month. Although he got out the largest attendance of the year in Washington, 55 being present, he did not take the $10 prize now being held by Maurice Caplan for his record-breaking turnout of 87 at the January Baltimore meeting.

The meeting was called to order by President Ken Huston after a recording of The National Anthem was played.

In the absence of the secretary, Ray Stricklen, who was celebrating his wedding anniversary, Walter Olson was appointed secretary for this meeting.

The minutes of the February meeting were read and approved.

President Huston read the financial report of the Banquet Committee due to absence from the meeting of any of the committee members. The report, which showed a profit of $9.72 accruing from the banquet, was approved by the committee, consisting of Frank Davey, Harry Irvin and Raymond Stricklen, Jr., was discharged with a vote of thanks from the Branch for a job well done.

A motion was made by S. Warnock, seconded by A. Pierdon, to increase the annual dues of the local branch from $6.00 to $7.00 effective May 1st, 1945. Motion was carried.

Sam Warnock then made a motion that the Branch contribute one dollar per member for the coming year to the Research Fund. In the discussion which followed, it was explained that the local branch would incur certain expenses in the activities of the local Research Committee to solicit funds. It was believed by some members that this additional expense should not be borne by the Branch Treasury, but should come either from contributions from the members or from the additional dues. Warnock withdrew his motion.

Dr. Blum gave a report on a meeting of The Research Committee held in Pittsburgh on March 2nd. The members in attendance at this meeting were informed that there would be no convention in Pittsburgh this year because of ODT regulations. However each branch is to send a delegate to a meeting to be held in Pittsburgh in order to conduct the business of the Supreme Society. Dr. Blum also reported that over $50,000 had been contributed to the Research Fund already, and he gave a brief summary of the research projects being carried on at Indiana University, University of Illinois and University of Michigan.

Tom Slattery read a proposed amendment to Section 6, Article VI of the By-Laws regarding a change in the constitution of The Research Committee and method of disbursing money from The Research Fund. A motion was made, seconded and carried that the Baltimore-Washington Branch sponsor this amendment and the secretary was instructed to forward it to the Executive Secretary for the necessary action to present it to the Supreme Society.

President Huston informed the branch of the difficulties being encountered in obtaining a satisfactory meeting place in Baltimore. He had made a preliminary investigation of affiliation with The Engineers' Club of Baltimore and reported on the advantages accruing from such an affiliation.

A committee consisting of Matthew Kraft, Al Taylor and Maurice Caplan was appointed to complete this investigation.

Fred Pierdon, Tom Slattery and L. G. Tubbs were appointed as a nominating

committee to nominate branch officers for 1945-1946. The election will be held at the May meeting.

Harry Borleis, Matthew Kraft and Frank Davey were appointed as a committee to audit the Treasurer's books and make a report at the May meeting.

Maurice Caplan reported that the local Research Committee had prepared its letter soliciting funds for the Research Fund. They expected to mail about three hundred letters to people interested in plating in this area.

Ken Huston reported that he had had difficulty in learning from the local members the names of the branch charter members and the branch officers. At the advisory council meeting he had asked Wendell Barrows to investigate the possibility of preparing a Branch History. Wendell reported that the *Monthly Review* during the early years of the Branch contained considerable information, but very little information after 1931 was available. Ken appointed Wendell as Branch Historian with instructions to choose two other members to act as a Branch Historical Committee. The history was to consist of a resumé of the outstanding events of each year together with the officers' names, the elections, resignations and suspensions in membership.

Huston then reported on the effort Fred Pierdon had extended in trying to arouse interest in electroplating apprentice training as sponsored by the United States Apprentice Training Commission. At Ken's request, Fred reported that apprentice training in all vocations was being sponsored by the Government for any trade. The course of practical training and supplementary educational subjects is outlined by an organization or a firm and if approved, the educational portion is sponsored by the Government. The plan provides for a definite training program in the shop and periodic pay increases at a predetermined rate. In the discussion it was brought out that our Society as a Society for the Advancement of the Science of Electroplating should take an active interest in the formulation of any plans for the training of apprentice electroplaters and buffers. It was voted that one of the early meetings of the 1945-1946 season be devoted to consideration of this subject and that one of the Regional Directors of the program be asked to explain the program in detail at that meeting.

The meeting, which was known as a "Stump The Experts" meeting, was then turned over to the Educational Session.

The rules, which had been announced in the meeting notice were read again and were:

The questions, furnished by the members, should be specific questions which could be answered by facts instead of by discussion. Answers to each question should be included with the question.

One dollar was paid for each question furnished which the experts could not answer provided the member asking the question was at the meeting.

The member present at the meeting sending in the largest number of questions had the cost of his dinner paid by the branch.

The experts were Wendell Barrows, William Blum, Fred Pierdon, Gustav Solderberg and Albert Taylor.

Tom Slattery played the role of Professor Quiz.

The judges were Harry Borleis, Albert Fry, Edward Peebles and Sam Warnock.

Thirty-eight questions were submitted.

The experts answered all but two. One dollar went to Chester Bethke for "What is the definition of a plater"? Answer: "One who shoes horses"; and the other dollar went to Ken Huston for his question, "At what pH (colorimetrically) should zinc base die castings be copper plated in a rochelle salt cyanide bath prior to chrome plating in order to minimize blistering of the plate"? Answer: "pH 8.6 to 9.4."

From the discussions of the questions, it was evident that many of the answers to modern electroplating processes are open to debate and discussion. Also, many of our plating processes having specific application to a desired product, are not generally known to the average plater, although they have been covered in *The Monthly Review* and in the *Convention Proceedings.*

Between the time of the meeting and these minutes were recorded, it has been learned that our Secretary, Ray Stricklen, has received his greetings from President Roosevelt. He will don the Navy Blue or Army Khaki on March 28th. Good luck, Ray! Your active interest in the Branch will be missed!

K. M. HUSTON, *For the Secretary*

BRANCH DIRECTORY

BALTIMORE-WASHINGTON meets at the Telford Buffeteria, 14th and Decatur Sts., N.W. Washington, D. C. the first Saturday of each month. Acting Secretary-Treasurer, Albert G. Taylor, 1209 E. 25th St., Baltimore 14, Md.

BOSTON meets at the Hotel Statler, Boston, Mass., first Thursday each month. Secretary, A. W. Garrett, 35 Rosemont St., Dorchester, Mass.

BRIDGEPORT meets first Friday of each month at Chamber of Commerce Rooms, Stratfield Hotel. Secretary-Treasurer, Joseph G. Sterling, 134 Colony St., Bridgeport 8, Conn.

BUFFALO meets second Friday of each month at Hotel Statler, Buffalo, N. Y. Secretary J. C. Mays, 8436 W. Rivershore Dr., Niagara Falls, N. Y.

CHICAGO meets second Friday of each month at 8 p.m., Atlantic Hotel, 316 S. Clark St. Secretary, M. H. Longfield, 1528 South 61 St., Cicero 50, Ill.

CINCINNATI meets on fourth Thursday of each month at 8 p.m., at the Engineering Society Headquarters, McMillan St. and Woodburn Avenue, Cincinnati, Ohio. Secretary-Treasurer, Elliott W. Horning, 2425 Kenilworth Ave., Norwood 12, Ohio.

CLEVELAND meets first Saturday of each month at Cleveland Hotel. Secretary-Treasurer, Harvey P. Heil, 12901 Elmwood Ave., Cleveland 11, Ohio.

DAYTON meets second Friday of each month at the Engineers Club, Dayton, Ohio. Secretary-Treasurer, W. M. Durnbaugh, R. R. 4, Xenia, Ohio.

DETROIT meets the first Friday of each month at the Hotel Statler. Secretary-Treasurer, F. L. Clifton, 18536 Inverness, Detroit 21, Mich.

GRAND RAPIDS meets second Friday of each month, 7:30 p.m., at the Rowe Hotel. Secretary-Treasurer, C. E. Abel, 11 Scribner Ave., Grand Rapids 4, Mich.

HARTFORD meets third Monday of each month alternately at Hartford Electric Light Company, Hartford and at the Elks Club, corner South and Main Sts., Bristol, Conn. Special meetings are held at the New Britain Trade School, New Britain, Conn. Secretary, F. W. Smith, 46 Cottage St., Meriden, Conn.

INDIANAPOLIS meets at the Hotel Riley, the first Wednesday of each month. Secretary-Treasurer, Carl B. Morris, 1828 N. Pennsylvania, Indianapolis, Ind.

JACKSON-LANSING meets second Tuesday of each month alternating between Home Dairy at Lansing and Hotel Hayes at Jackson. Secretary-Treasurer, C. E. Topping, 1104 S. West Ave., Jackson, Mich.

LANCASTER meets second Friday of each month at 8 p.m., at Thaddeus Stevens Industrial School, Lancaster, Pa. Secretary-Treasurer, W. H. Fordney, 603 Marietta Ave., Lancaster, Pa.

LOS ANGELES meets the second Monday of each month, 6:30 p.m. at the Rosslyn Hotel, corner Fifth and Main Sts. Secretary-Treasurer, Frank Bunker, 2030 Bay St., Los Angeles, Calif.

MILWAUKEE meets first Friday of each month at Wisconsin Hotel. Secretary-Treasurer, James Durnford, 2370 N. 32nd St., Milwaukee 10, Wis.

MONTREAL meets first Monday of each month at Mount Royal Hotel, Montreal, Quebec, Canada. Secretary-Treasurer, W. G. Finlay, 5670 16th Ave., Rosemount, Montreal.

NEWARK meets first and third Friday of each month at Hotel Robert Treat, Newark, N. J., at 8 p.m. Secretary-Treasurer, George Wagner, 1130 So. Long Ave., Hillside, N. J.

NEW HAVEN meets the first Tuesday of each month at Sterling Chemistry Laboratory, Yale University. Secretary-Treasurer, B. J. Gaffney, 40 Filbert St., Spring Glen, Hamden 14, Conn.

NEW YORK meets second and fourth Fridays of each month, in the Hotel Pennsylvania, 7th Ave. and 33rd St., New York City, N. Y. Secretary-Treasurer, Franklyn MacStoker, 25 Princeton St., Garden City, L. I., N. Y.

PHILADELPHIA meets fourth Friday of each month, in the Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Sts. Secretary, Paul Mentzer, Sr., 7242 Bingham St., Philadelphia 11, Pa.

PITTSBURGH meets third Thursday of each month, at 6:30 p.m. at the Roosevelt Hotel, Pittsburgh, Pa. Secretary-Treasurer, Frank Keller, 1102 Hiland Ave., Coraopolis, Pa.

PROVIDENCE-ATTLEBORO meets the third Monday of each month at the Providence-Baltimore Hotel. Secretary-Treasurer, Chas. C. Chace, 11 Friendly Road, Cranston 10, Rhode Island.

ROCKFORD, Secretary, Stuart Goldjng, J. F. Clark Mfg. Co., Rockford, Ill.

ROCHESTER meets third Friday of each month at the Hotel Seneca, Rochester, N. Y. Secretary-Treasurer, Donald C. Blum, 672 Mt. Read Blvd., Rochester, N. Y.

SAN FRANCISCO meets the last Thursday of each month, usually at Angelo's, 4307 San Pablo Avenue, Oakland, Calif. Secretary-Treasurer, Arthur Kistler, 15th and Vermont Sts., San Francisco, Calif.

SPRINGFIELD meets the fourth Monday of each month at the Hotel Charles. Secretary-Treasurer, Paul Lyman, Westinghouse Electric & Mfg. Co., Springfield, Mass.

ST. LOUIS meets first Friday of each month at Central Y. M. C. A., 16th and Locust Sts. Secretary-Treasurer, C. T. McGinley, 8319 Garfield, St. Louis, County 14, Mo.

SYDNEY, AUSTRALIA. Secretary-Treasurer, Lawrence Smith, Box 2064, G.P.O., Sydney, Australia.

SYRACUSE meets second Friday of each month at Bowne Hall, Syracuse University, Syracuse, N. Y. Secretary, Neil Maffei, 206 Union Ave., Syracuse 3, N. Y.

TOLEDO meets first Thursday of each month, in the office of the Vic Miner Co., 329 20th Street, Toledo, Ohio. Secretary, Gaston Bergeman, 718 Howland St., Fremont, Ohio.

TORONTO meets second Friday of each month at Royal York Hotel. Secretary, E. P. Blandy, 369 Prince Edward Drive, Toronto 9, Ont., Canada.

TWIN CITY BRANCH. Secretary-Treasurer, Robert Buckley, 1410 Quincy St., N.E., Minneapolis 13, Minn.

WATERBURY meets second Friday of the month at Elton Hotel. Secretary-Treasurer, Spencer L. Henn, Apothecaries Hall Co., Waterbury 88, Conn.

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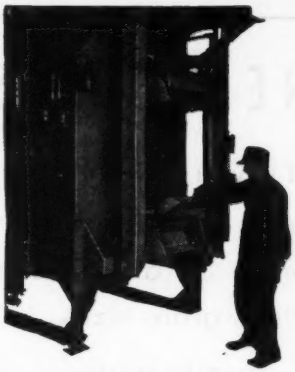

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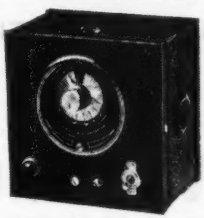

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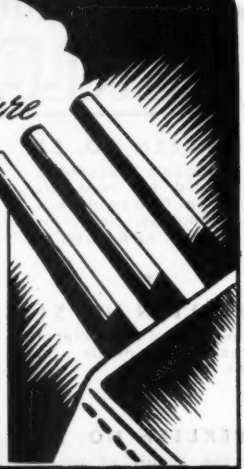

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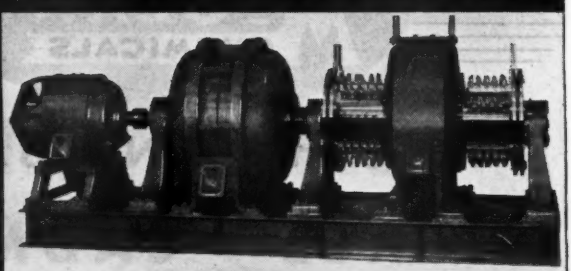

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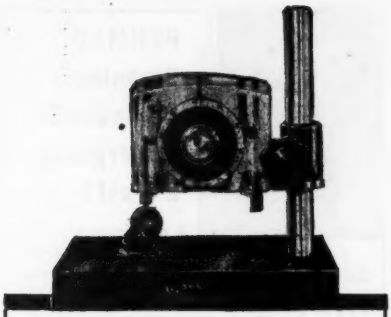

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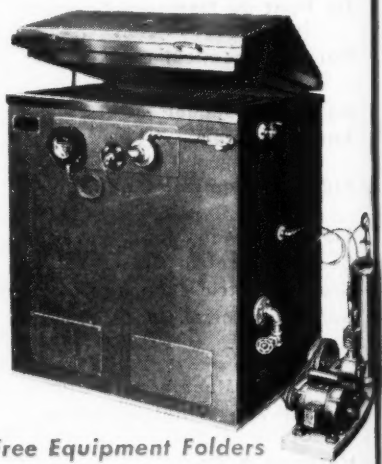

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